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A Study of the Use of Music as an Aid in Teaching Swimming[1]

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SWIMMING to the accompaniment of music or with music as a background is not something new. In recent years many college swimming clubs have been using music as an accompaniment for their swimming. Some teachers interested in this type of swimming have used music with instructional swimming classes and have found that students, as a general rule, enjoy this type of instruction. Many coaches, instructors, and aquatics officials believe rhythm is important in both speed swimming and form swimming.

A review of the literature indicates that many scientific investigations have been conducted which were concerned with both the psychological and the physiological effects of music on man and his emotions (2). There is some evidence that music is of value in work, in recreation, in the treatment of the sick, and in certain physical education activities (1, 2, 3, 4, 5, 6, 8). Much of this evidence, however, is based upon the subjective judgment of individuals, and very few experimental investigations have been conducted.

The importance of rhythm in both swimming speed and swimming form raises several questions. Is it possible to emphasize rhythm in instructional swimming classes by the use of music as a teaching aid? Would the use of music make it easier for the swimmer to feel the rhythm essential for a good stroke? Would the use of music result in quicker learning or in more complete learning? Is there any way of measuring the value of the use of music as an aid in teaching swimming?

Because it was believed that an experimental study might serve as a means of measuring the value of music as an aid in teaching swimming, this study was undertaken.

Statement of the Problem

The purpose of this study was to determine, by means of the experimental method of teaching, the value of the use of music as an aid in teaching swimming. This value was determined by improvement in speed and form for two standard strokes—the crawl stroke and the breast stroke. Speed was measured by the stop-watch. Form was measured by the subjective judgment of three rated aquatics officials who used the ten-point rating scale and followed the rules found in the *Official Aquatics, Winter Sports and Outing Activities Guide,*

[1] An abstract of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Physical Education for Women in the Graduate College of the State University of Iowa, June 1950.

1949–1951 (7). In judging form, each judge considered the rhythm, the relaxation, the power, and the form of the stroke as it was executed. A score for the stroke was then given. This score was based on the following scale:

Completely failed	0
Unsatisfactory	1–2½
Deficient	3–4½
Satisfactory	5–6½
Good	7–8½
Very good	9–10

This study was limited to college women who were classified as intermediate swimmers and had had no previous experience in swimming with music.

Procedure

This study was conducted at Wellesley College over a period of three years, with a total sampling of 240 swimmers.

Each year the swimmers were placed in either the Non-Music Group (control) or the Music Group (experimental). The selection of swimmers was by random sampling. The procedure followed was to test, teach, and then re-test. The groups were equated on the basis of the initial tests. These tests were: (a) Seashore Rhythm Perception Test, (b) crawl stroke form, (c) breast stroke form, (d) 40-yard crawl stroke, (e) 40-yard breast stroke, and (f) total time for the two 40-yard events. (During the first year the initial tests also included the Iowa Revision of the Brace Test, a 75-yard crawl stroke and a 75-yard breast stroke. These were eliminated from the study for the second and third years because they were time-consuming and because the results of the statistical treatment of data at the end of the first year indicated that these tests were not essential.) The initial testing took approximately four class periods.

Approximately 12 lessons were devoted to experimental teaching. The procedure and the content of these lessons were the same for both groups, with the single exception that music was used as much as possible with the Music Group and that the Non-Music Group never used music. For the Music Group, the tempo of the music was stressed when specific skills were practiced and music was used at all times when the students were actually swimming.

The final testing was completed during the last four lessons of the series of approximately 20 lessons. The final tests were the same as the initial tests but the Seashore Rhythm Perception Test was omitted, inasmuch as this test was not a test of swimming ability.

The data for each year and for the three years combined were treated statistically. Means, standard deviations, and standard errors of the means were calculated for each group for the initial scores, the final scores, and the improvement scores. Several coefficients of correlation were computed by the Pearson Product-Moment Method. Critical ratios, or differences between the means of the two groups, were calculated using the following formula:

$$\text{C.R.} = \frac{M_a - M_b}{\sqrt{S.E._{M_a}^2 + S.E._{M_b}^2}}$$

Results

The means, standard deviations and critical ratios for the initial scores, final scores, and improvement scores for each year will be found in Tables 1, 2, and 3.

To determine the results for the total sampling of 240, the raw scores for all three years were used. Table 4 shows the initial scores, final scores, and improvement scores of the total sample of 240. For the initial tests (see *Procedure*) the mean scores of the Music Group were slightly higher than those of the Non-Music Group in the case of the form swimming events; and the mean scores of the Non-Music Group were slightly lower than those of the Music Group in the case of the speed swimming events.

For the total sampling of 240 students, the critical ratios for the initial scores ranged from 0.04 to 1.70. Inasmuch as none of these was high enough to be considered significant at even the five per cent level of confidence, it was assumed that the two groups were equated on the basis of the initial tests.

The mean improvement scores of the Music Group were better in all instances than were those of the Non-Music Group (see Table 4). The critical ratio for improvement in crawl stroke form was 3.46, and the critical ratio for breast stroke form was 2.46. These two critical ratios were significant at the 0.06 per cent level of confidence and the 1.5 per cent level of confidence, respectively. The critical ratios for the speed swimming events ranged from 0.98 to 1.31 and were not large enough to be considered significant.

The critical ratios or tests of difference between means of the two groups for each year and for the three years combined are found in Table 5.

It was believed that both the 40-yard speed events and the 75-yard speed events were not essential as factors for measuring speed in swimming. Using the raw scores of the first year, the coefficient of correlation was calculated for the initial 40-yard crawl stroke and 75-yard crawl stroke, for the initial 40-yard breast stroke and 75-yard breast stroke, for the final 40-yard crawl stroke and 75-yard crawl stroke, and for the final 40-yard breast stroke and 75-yard breast stroke. The coefficients of correlation for the crawl stroke were 0.81 ± 0.040 and 0.86 ± 0.030 for the initial and final tests respectively, and those for the breast stroke were slightly higher, being 0.97 ± 0.007 and 0.94 ± 0.013 for the initial and final tests, respectively.

These four coefficients of correlation were large enough to indicate a high positive correlation between the 40-yard events and the 75-yard events. On the basis of these results, the writer decided to eliminate the 75-yard speed events from the battery of tests to be used during the second and third year. The 40-yard speed events were retained rather than the 75-yard speed events because it was easier to motivate students to maximum effort for the shorter distance and the 40-yard events were less time-consuming and were easier to administer.

Scores for the Iowa Revision of the Brace Test were correlated with total time improvement scores. This coefficient of correlation was -0.02 ± 0.117. The size of this coefficient of correlation would seem to indicate that there was

TABLE 1

First Year: Means, Standard Deviations, and Critical Ratios for Initial Scores, Final Scores, and Improvement Scores of Music Group and Non-Music Group

Tests	Music Group N = 38		Non-Music Group N = 34		C.R.
	Mean	S.D.	Mean	S.D.	
Initial Scores					
Rhythm perception	25.76	2.81	25.03	3.73	0.92
Crawl stroke form	5.78	0.95	5.36	0.90	1.94
Breast stroke form	5.17	0.97	4.97	0.97	0.84
40-yard crawl stroke	46.71	7.50	48.48	8.78	0.90
40-yard breast stroke	68.07	13.24	68.40	14.45	0.10
Total time	114.78	17.44	116.88	20.37	0.46
Final Scores					
Crawl stroke form	6.56	0.96	5.73	0.97	3.60
Breast stroke form	5.69	1.17	5.41	1.00	1.06
40-yard crawl stroke	43.89	6.38	45.93	7.06	1.26
40-yard breast stroke	60.23	8.71	60.83	10.35	0.26
Total time	104.12	11.46	106.76	15.18	0.81
Improvement Scores					
Crawl stroke form	0.78	0.97	0.38	0.71	1.98
Breast stroke form	0.52	0.68	0.44	0.84	0.43
40-yard crawl stroke	2.82	4.72	2.55	4.31	0.25
40-yard breast stroke	7.84	9.20	7.57	7.98	0.13
Total time	10.66	12.68	10.12	9.71	1.98
Attendance	17.55	1.58	17.35	1.28	0.58

TABLE 2

Second Year: Means, Standard Deviations, and Critical Ratios for Initial Scores, Final Scores, and Improvement Scores of Music Group and Non-Music Group

Tests	Music Group N = 47		Non-Music Group N = 47		C.R.
	Mean	S.D.	Mean	S.D.	
Initial Scores					
Rhythm perception	26.51	2.95	25.98	2.67	0.91
Crawl stroke form	4.68	1.04	4.70	1.29	0.10
Breast stroke form	4.14	1.20	4.38	1.18	0.96
40-yard crawl stroke	52.32	12.40	50.64	13.43	0.62
40-yard breast stroke	72.54	16.55	68.49	12.68	1.31
Total time	124.86	25.67	119.14	21.43	1.16
Final Scores					
Crawl stroke form	5.67	1.03	5.33	1.15	1.51
Breast stroke form	5.03	1.28	5.05	1.28	0.06
40-yard crawl stroke	47.15	9.53	46.55	9.79	0.30
40-yard breast stroke	66.86	14.38	63.67	9.11	1.27
Total time	114.00	12.61	110.22	16.15	1.25
Improvement Scores					
Crawl stroke form	0.95	0.73	0.60	0.86	2.09
Breast stroke form	0.91	0.72	0.67	0.87	1.48
40-yard crawl stroke	5.15	5.56	4.10	7.75	0.75
40-yard breast stroke	5.68	7.33	4.82	10.10	0.47
Total time	10.83	10.50	8.92	13.39	0.76
Attendance	20.77	1.08	20.26	1.28	2.07

TABLE 3

Third Year: Means, Standard Deviations, and Critical Ratios for Initial Scores, Final Scores and Improvement Scores of Music Group and Non-Music Group

Tests	Music Group N = 35		Non-Music Group N = 39		C.R.
	Mean	S.D.	Mean	S.D.	
Initial Scores					
Rhythm perception	26.83	2.32	26.05	2.42	1.39
Crawl stroke form	4.87	0.91	4.87	0.74	0.00
Breast stroke form	4.09	1.13	4.06	0.67	0.11
40-yard crawl stroke	45.73	10.05	45.95	9.48	0.09
40-yard breast stroke	65.78	17.52	65.16	12.77	0.17
Total time	111.52	25.50	111.11	21.38	0.07
Final Scores					
Crawl stroke form	5.70	0.98	5.32	1.06	1.57
Breast stroke form	5.02	1.32	4.54	1.00	1.71
40-yard crawl stroke	43.94	5.31	44.89	7.41	0.63
40-yard breast stroke	62.01	11.70	63.72	11.54	0.62
Total time	105.95	16.67	108.61	17.42	0.66
Improvement Scores					
Crawl stroke form	0.83	0.78	0.45	0.82	1.97
Breast stroke form	1.01	1.12	0.48	0.69	2.37
40-yard crawl stroke	1.79	6.61	1.06	4.94	0.53
40-yard breast stroke	3.77	9.76	1.44	6.56	1.18
Total time	5.56	14.02	2.49	9.46	1.08
Attendance	22.49	1.48	22.67	1.16	0.57

TABLE 4

Three Years Combined: Means, Standard Deviations, and Critical Ratios for Initial Scores, Final Scores, and Improvement Scores of Music Group and Non-Music Group

Tests	Music Group N = 120		Non-Music Group N = 120		C.R.
	Mean	S.D.	Mean	S.D.	
Initial Scores					
Rhythm perception	26.37	2.77	25.73	2.97	1.70
Crawl stroke form	5.09	1.09	4.94	1.06	1.03
Breast stroke form	4.45	1.21	4.44	1.04	0.04
40-yard crawl stroke	48.62	10.80	48.51	11.20	0.08
40-yard breast stroke	69.15	16.15	67.38	13.34	0.92
Total time	117.78	24.04	115.89	21.40	0.64
Final Scores					
Crawl stroke form	5.96	1.07	5.44	1.09	3.72
Breast stroke form	5.24	1.29	4.99	1.17	1.56
40-yard crawl stroke	45.18	7.69	45.83	8.37	0.63
40-yard breast stroke	63.35	12.40	62.88	10.38	0.31
Total time	108.53	14.32	108.72	16.31	0.09
Improvement Scores					
Crawl stroke form	0.86	0.83	0.49	0.82	3.46
Breast stroke form	0.82	0.87	0.55	0.86	2.46
40-yard crawl stroke	3.43	5.82	2.67	6.20	0.98
40-yard breast stroke	5.81	8.84	4.50	8.86	1.14
Total time	9.24	12.53	7.17	11.70	1.31
Attendance	20.25	2.40	20.22	2.41	0.11

no relationship between motor educability, as measured by the Iowa Revision of the Brace Test, and improvement in swimming speed.

The scores for the Rhythm Perception Test were correlated with the improvement scores for each group for each test. These coefficients of correlation are found in Table 6. The coefficients of correlation for the Music Group were all positive, whereas three coefficients of correlation for the Non-Music Group

TABLE 5

Critical Ratios for Initial Scores, Final Scores, and Improvement Scores of Music Group and Non-Music Group

Tests	First Year	Second Year	Third Year	Three Years
Initial Scores				
Rhythm perception	0.92	0.91	1.39	1.70
Crawl stroke form	1.94	0.10*	0.02	1.03
Breast stroke form	0.84	0.96*	0.11	0.04
40-yard crawl stroke	0.90	0.62*	0.09	0.08*
40-yard breast stroke	0.10	1.31*	0.17*	0.92*
Total time	0.46	1.16*	0.07*	0.64*
Final Scores				
Crawl stroke form	3.60	1.51	1.57	3.72
Breast stroke form	1.06	0.06*	1.71	1.56
40-yard crawl stroke	1.26	0.30*	0.63	0.63
40-yard breast stroke	0.26	1.27*	0.62*	0.31
Total time	0.81	1.25*	0.66	0.09
Improvement Scores				
Crawl stroke form	1.98	2.09	1.97	3.46
Breast stroke form	0.43	1.48	2.37	2.46
40-yard crawl stroke	0.25	0.75	0.53	0.98
40-yard breast stroke	0.13	0.47	1.18	1.14
Total time	1.98	0.76	1.08	1.31
Attendance	0.58	2.07	0.57*	0.11

* In these instances, the mean score for the Non-Music Group was better than the mean score for the Music Group.

TABLE 6

Coefficients of Correlation of Rhythm Perception Scores with Improvement Scores

N = 120	Music Group	Non-Music Group
Crawl stroke form	0.03 ± 0.091	0.14 ± 0.089
Breast stroke form	0.05 ± 0.091	0.07 ± 0.091
40-yard crawl stroke	0.04 ± 0.091	−0.13 ± 0.089
40-yard breast stroke	0.05 ± 0.091	−0.13 ± 0.089
Total time	0.06 ± 0.091	−0.18 ± 0.088

were negative. The coefficients ranged from −0.18 to 0.14. Coefficients of correlation of this size would seem to indicate that there was no relationship between rhythm perception as measured by the Seashore Rhythm Perception Test and improvement in swimming form or improvement in swimming speed.

For each group the improvement scores for form were correlated with the improvement scores for speed for both the crawl stroke and the breast stroke. For the crawl stroke the coefficients of correlation were 0.11 ± 0.090 for the

Music Group and 0.01 ± 0.091 for the Non-Music Group. For the breast stroke the coefficients of correlation were −0.02 ± 0.091 for the Music Group and −0.11 ± 0.090 for the Non-Music Group. Coefficients of correlation of this size would seem to indicate that there was no relationship between improvement in form and improvement in speed for either the crawl stroke or the breast stroke. The writer was unable to account for these low correlations. The one factor in the testing procedure which could not be controlled was the extent to which swimmers could be motivated to maximum effort. The writer believes this factor might have accounted for these low correlations.

Evaluation of Results

It was believed that the two groups were sufficiently equated insofar as swimming skill was concerned. Every effort was made to keep the procedure and the content of lessons similar for the two groups, with the single exception that music was used with one group and was not used with the other group. The one factor in the testing procedure which could not be controlled was the extent to which swimmers could be motivated to maximum effort.

The inclusion of the Seashore Rhythm Perception Test was of doubtful value as an equating factor but it was retained for several reasons. Including this test made it possible to study the relationship of rhythm perception, as measured by this test, to improvement in swimming form and improvement in swimming speed. The test could be given in approximately 15 minutes and so very little time would have been saved by eliminating it.

Swimming endurance was not included as a factor on which the two groups were equated. Possibly this should have been included but its inclusion would have presented several problems. First, there would have been the question of the selection of the stroke to be used. If either the crawl stroke or the breast stroke had been selected, it would have seemed logical to have included not one but both, since these two strokes were used in all other measurements of improvement. This would have shortened the amount of time devoted to the experimental teaching. Second, it is doubtful if there would have been sufficient time in one class period for each swimmer to swim to the limit of her maximum endurance.

Inasmuch as all subjects for this study were enrolled in regularly scheduled classes, certain limitations were inevitable but were controlled to the extent that the two groups were comparable. These limitations were: (a) the number of lessons in each series, (b) the length of each lesson, (c) the occurrence of two vacation periods, (Christmas and mid-year) in the series of approximately 20 lessons, and (d) the varied content of the lessons.

If these limitations had not existed, it might have been reasonable to expect the scores for each group to be less variable and the mean improvement scores for each group to be somewhat higher than they actually were. It is impossible to predict whether or not less variability within each group and greater mean improvement for each group would have resulted in a greater difference in the means.

Conclusions

The following conclusions are based upon the data obtained from this study:

1. Intermediate swimmers being taught with music improve more in swimming form and swimming speed than do swimmers who are taught without music. Mean improvement scores of the Music Group were better in all instances than were those of the Non-Music Group.

2. There is no relationship between motor educability, as measured by the Iowa Revision of the Brace Test, and improvement in swimming speed. The coefficient of correlation between the Iowa Revision of the Brace Test and improvement in swimming speed was -0.02 ± 0.117.

3. There is no relationship between rhythm perception, as measured by the Seashore Rhythm Perception Test, and improvement in swimming form or improvement in swimming speed. The coefficients of correlation between the Seashore Rhythm Perception Test and improvement scores ranged from -0.18 to 0.14.

4. There is no relationship between improvement in swimming form and improvement in swimming speed for either the crawl stroke or the breast stroke. The coefficients of correlation between improvement in form and improvement in speed ranged from -0.11 to 0.11.

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A Study of the Effects of Training in Ball Throwing by Children Ages Three to Seven[1]

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IT HAS BEEN assumed frequently that the learning of motor skills at an early age is advantageous. Few studies have been done, however, to determine how young a child may be and still show definite improvement due to instruction—improvement over and above the effects of maturation and general practice. In addition, data which show the effects of such factors as sex and initial skill on the amount of learning a child acquires from a given amount of instruction, are very meager.

A study by Hicks (6), using children from ages two and one-half to six and one-half years, revealed that eight weeks of throwing a ball at a moving target yielded no greater gains than were produced in a control group by structural growth and general practice. Various investigators—among these, Gesell (3), Wild (9), Gutteridge (4), and Jenkins (7)—have studied the initial throwing ability of children. They found that this skill increased with each age level from two to 12, with boys showing a definite superiority at all ages.

Purpose

The purpose of this study was to investigate the learning in ball throwing for distance by young boys and girls due to specific training. Sub-problems investigated were the relation of throwing ability to: (a) sex, (b) age, (c) ability in broad jumping, and (d) the manner of throwing.

Procedures

SUBJECTS

The experiment was done on 56 subjects, ranging in age from three to seven years, who were attending Nursery Schools and Child Care Centers in Berkeley, California. The children were given an initial test in throwing (five balls thrown for distance) and in jumping (standing broad jump). Two groups of 28 children were then equated on the basis of age, sex, race, and the average distance of the five throws. One of these groups received practice and instruction in throwing twice a week over a period of three weeks, while the other was used as a control group.

[1] An abstract of a thesis presented in partial satisfaction of a Master of Arts degree for the Department of Physical Education, University of California, Berkeley, September 1950.

INITIAL TEST IN THROWING

During the first week of the experiment all subjects were given an initial test which consisted of five trials. All throws were for distance using "dead" tennis balls. The tennis ball was chosen because, although it was slightly large for some of the younger children's grasps, it provided a standard-sized ball which was readily available.

The children were taken individually or in couples to an open, level area where a "throwing line" was drawn. The general directions to each child were, "You stand behind this line and see how far you can throw the ball—like this," and a demonstration of an overhand throw was made. No further instructions or encouragement were given, except to clarify the fact that the object of the game was to see how far the ball went before it hit the ground. Five balls were thrown, one after the other, and the points where they first hit were marked. The distance of the throw was measured to the nearest inch with a steel tape. The throwing method used by each child was checked on a card designed especially for the purpose.

Training in Throwing

Each of the 28 children in the trained group participated in six instruction periods. At the beginning of each period five practice throws were taken. Placement of the left foot slightly forward was insisted upon (all of the children threw right-handed), as well as an overhand movement in throwing. Instruction was given, when it seemed necessary, as to weight shift and body rotation. Changes in arm movement and release of the ball were also attempted. Demonstrations were frequent and, with the younger children, the parts of the body usually had to be placed in the desired position. When a poor throw was made, a simple explanation was given as to the reason.

Following the practice throws, five more throws were made and their distances recorded. Reminders of instructions were given during these throws, and in order to ensure maximum interest and co-operation from this age group, verbal praise and a candy reward were given if the scores indicated any improvement over previous throwing periods.

During the fifth week after the initial throwing tests, all subjects in both the control and trained groups were retested. The procedure was the same as during the initial testing.

Test in Jumping

Simultaneously with the initial and the final throwing tests, the children were measured as to their jumping ability by a standing broad jump. The average was taken of three jumps. This measure was included because a number of investigators—among these, Carpenter (1), Cowan (2), and Hartman (5)—have found it a reliable measure and one closely related to maturation.

Results

After an analysis of the data for these groups on the throwing and jumping tests, the following are some of the more important results:

1. On the initial throws for distance the boys were superior to the girls. The boys had a mean score of 23.7 feet and the girls a mean score of 16 feet.

2. The ages of the children and their initial throwing scores gave a correlation of 0.70 for the boys and 0.62 for the girls. Since these correlations are statistically significant, it is evident that throwing ability showed a definite relationship to age for ages three to seven.

TABLE 1

Differences Between Beginning and Final Throwing Averages for Boys

No. of Subjects	Age in Years	Throws in Feet		Gain	
		Initial	Final	Feet	Per cent
CONTROL					
5	3	16.2	16.8	0.6	3.5
5	4	21.6	27.6	6.0	27.6
2	5	26.1	27.8	1.7	6.7
2	6	43.8	45.5	1.7	3.8
14	3–6	23.5	26.5	3.0	12.8
TRAINED					
3	3	18.8	22.6	3.8	20.3
5	4	17.3	21.4	4.1	23.5
4	5	30.5	34.4	3.9	12.8
2	6	35.0	53.2	15.2	52.1
14	3–6	24.0	30.0	6.0	25.0

TABLE 2

Differences Between Beginning and Final Throwing Averages for Girls

No. of Subjects	Age in Years	Throws in Feet		Gain	
		Initial	Final	Feet	Per cent
CONTROL					
4	3	11.1	12.3	1.2	10.5
5	4	14.6	15.5	0.9	6.3
3	5	17.3	16.3	−1.0	−5.8
2	6	24.7	24.0	−0.7	−2.7
14	3–6	15.7	16.0	.3	2.1
TRAINED					
4	3	11.9	13.7	1.8	15.3
5	4	15.2	15.0	−0.2	−1.1
3	5	18.9	23.0	4.1	21.6
2	6	24.4	29.5	5.1	20.8
14	3–6	16.3	18.4	2.1	12.7

3. As can be seen in Tables 1 and 2, both the practice and control groups made gains in average throwing scores from the initial to final test. The gain of the trained group was 4 feet ± 1.13 which is highly significant at better than the 1-per cent level of confidence (t = 3.54). The control group had a gain of 1.33 feet ± 0.80 which is significant at the 10-per cent level of confidence (t = 1.66). The difference in the gains of the trained and control groups is significant at the 7-per cent level of confidence (t = 1.89). This evidence suggests that, due to specific training in throwing over a five-week period, learning occurred over and above the effects of maturation and general practice.

4. The trained boys showed a gain from initial to final test which was highly significant, while the gain of the trained girls was significant at the 5-per cent level of confidence. The difference in gains of the trained boys and trained girls is 3.95 feet ± 2.16 which is significant at the 7-per cent level of confidence (t = 1.93). This indicates that, as a result of training over a short period of time, boys improve more in distance-throwing skill than do girls with the same amount of training.

5. A comparison of the initial score and the amount of gain made by each of the trained boys yielded a slight but positive correlation (0.46), which indicates that the boys who threw well on the initial test tended to have larger gains. The same comparison for the girls yielded no relationship (−0.12).

6. Figures I and II show the average scores for the trained group as compared with the control group. Because of the small number of cases at any one age level, the children were divided into two groups—the 3 and 4 year olds and the 5 and 6 year olds. It may be seen that the 3 and 4 year old boys and girls of the trained groups show little improvement, whereas the gain made by the 5 and 6 year olds is marked. Thus, it would appear that the older children profited more by training in throwing.

7. There was a small, though not significant, increase in the average jumping scores from the initial to final test—averaging 1.5 inches. This may be due to maturity, general practice, or familiarity with the test and tester; or to all three factors. There was very little sex difference in jumping ability, which is similar to the findings of Jenkins. This adds more evidence to the hypothesis that jumping activities receive more general practice by both sexes and, as such, may be considered more closely related to maturation than is throwing, which shows a significant sex difference.

8. Children were found to vary greatly in their manner of throwing. On the average, the boys evidenced better use of their bodies than did the girls and had more advanced arm and hand movements in executing throws.

The most marked change in throwing style due to training was found in the stance. After the second training period all of the children used the left-foot-forward stance without being reminded. In most cases this automatically caused greater body rotation and coincided with an increase in distances thrown. The greatest difficulty in training was encountered when the tester tried to improve arm movements and use of the fingers. It may be that some of the decreases

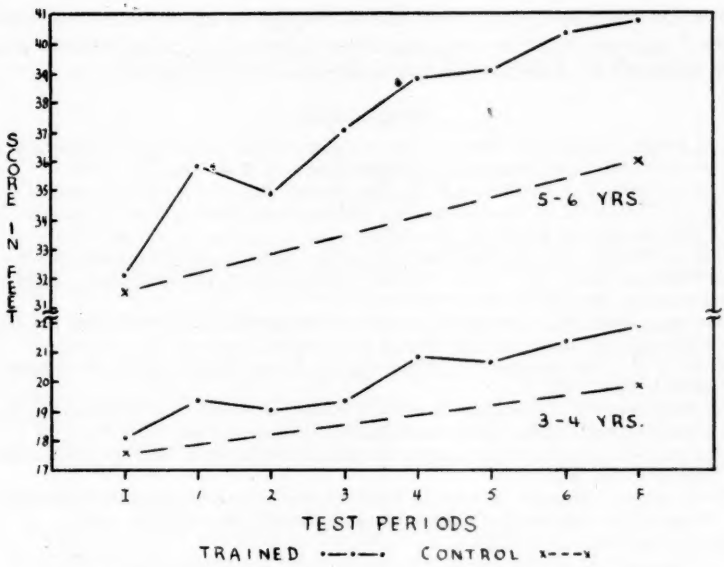

Fig. I. Average Distances Thrown by Boys in Trained and Control Groups

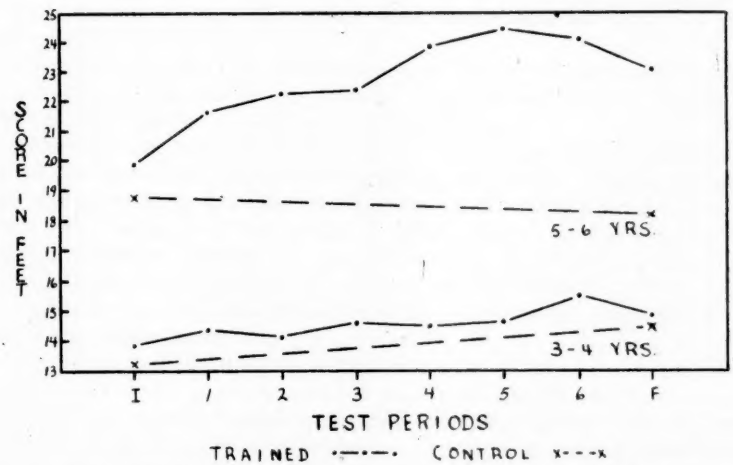

Fig. II. Average Distances Thrown by Girls in Trained and Control Groups

in average distances thrown were due to changes in the manner of throwing. Radical changes in style were sometimes followed by poorer throws which were observed to be due to lack of co-ordination of body parts.

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The Prediction of Baseball Ability

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FEW PEOPLE are aware of the amount of time used by a coach in his effort to obtain a knowledge of the potential abilities of his players. He must have this knowledge in order to select a squad successfully, and as a further step, to be able to distinguish accurately the players from the reserves.

In large schools especially, the coach is apt to overlook potentially good players who may have never played the game, but who could well develop rapidly under tutelage. In selecting his squad, the coach must take care not to overlook players with latent potentialities as well as not to retain players without potentialities. This division must be as clear and clean-cut as possible.

The Problem

However, if this selecting of the desirable from the undesirable is based entirely on the judgment of the coach, it will vary, obviously, according to his ability in this respect. The number of errors in selection might well be reduced if an objective way of selecting players was available to reinforce his judgment. Hence, this study was undertaken in an effort to devise a battery of screening tests by which the selection of individuals to play baseball could be more accurately made.

A review of the literature shows that research in baseball has been limited up to the present time. No studies were found which attempted to predict general baseball ability.

A study by Bates (1, *p. 7*) showed a correlation of 0.81 between an eye-hand co-ordination test and batting averages of high school baseball players. This test could be used as a predictor of batting ability.

Slater-Hammel and Stumpner (2) found that the starting reaction time, the time it takes to start a baseball bat moving upon seeing a visual stimulus, of 25 physical education majors was 0.21 seconds, and that the movement reaction time, a measure of the speed with which a person could change the direction of a moving baseball bat, was 0.27 seconds. Implication of the study is that a batter has to decide whether or not he is going to hit the ball when it is approximately half the distance from the pitcher to the catcher in order to have a successful reaction.

Burley (3, *p. 9*), in studying reaction time, found that baseball players had lower mean scores (faster reaction) in simple and complex reaction tests than had football linemen, football backs, basketball players, swimmers, high-school letter winners, and non-letter winners. The study, however, did not attempt to correlate player's ability with the reaction test scores.

Kenny (4) ascertained the speeds of different types of pitched balls but did not attempt to determine throwing accuracy, and Puck (5) analyzed the swing

of a baseball bat in hitting a baseball, without regard to either eye-hand co-ordination or reaction speed.

Procedure

Thirty University of Iowa varsity baseball players were tested by the author, and rated according to playing ability[1] by Coach Otto H. Vogel. The ratings were used as the criteria against which the test results were correlated.

To determine the tests to be given, the qualities needed by a proficient baseball player in each position were listed. These lists were pooled and then discussed with the physical education faculty and coaches who were familiar with baseball.

The following qualities were selected as essential to proficient baseball players:

1. Ability to throw for distance (highly correlated with speed of throw).
2. Running speed and agility.
3. Eye-hand co-ordination.
4. Fast reaction time.
5. Ability to judge distance.
6. Ability to visualize spatial relationships.
7. Ability to make decisions quickly.
8. Ability to throw accurately.
9. Ability to relax properly.
10. Motor capacity.

Since time is an important factor in preparing a baseball team for competition, tests for predicting ability should not involve long testing periods or lengthy preparations. The following qualities were selected and measured on that basis.

Ability to throw for distance: In this test, the subject was instructed to take his proper warm-up and then to throw as far as he could. He was told that the best throwing angle was approximately 45°. He was further instructed to take several steps before throwing and to make use of the torque of his body. The number of steps did not matter as long as he finished just behind the starting line when his throwing movement was completed. He was given three trials and the best throw was used in the analysis of data.

Running speed and agility: The shuttle run (6, *p. 118–19* and personal communication from McCloy to the author) was used for testing this quality. The zones were modified from the original test to allow for the stopping and starting of the runner. The first and fifth zones were 4 feet in length, the second and fourth zones were 5 feet 9 inches in length, and the third zone was 10 feet 6 inches in length. The time limit was 15 seconds, so that endurance was not a significant factor. All subjects wore baseball shoes.

Ability to visualize spatial relationships: Thurstone's "S" test (7, *p. 36*) was used to measure this quality. Thurstone found a significant relationship between the space factor and the three items of flags, cards, and figures used in

[1] Playing ability was based on each player's performance the previous year in regards to hitting (batting average, runs batted in), fielding (chances handled, errors), base running, and execution of the various play situations.

this test. Since this study was completed, additional space factors have been found (8).

Ability to make decisions quickly: The blocks test (9) was used to measure this quality. This test is designed to measure speed in making correct choices by the use of 24 wooden blocks three inches square and one inch thick. The tops of the blocks are painted red, white, blue, and green (six of each) and the bottoms are painted the same four colors but the color on the top is no indication of the color on the bottom. The blocks are arranged into two rows with the blocks in the top row running red, blue, red, etc., from left to right and the blocks in the bottom row running white, green, white, etc., from left to right.

To take the test the subject first memorizes the color sequence of red, white, blue, green, red, white, blue, etc.; then he is told to pick up the first block, look at the color on the bottom, replace this block and then pick up the next block which is of the color, according to the color sequence, following the color on the bottom of the first block; for example, the subject picks up the first block (red), the color on the bottom is blue. He should replace this block and pick up the next green block, for green is the color following blue in the color sequence; he should then look at the color on the bottom of the green block which is red; replacing this block, he should pick up the next white block, for white is the color following red in the color sequence.

Some blocks have a black circle around the color on the bottom. If, for example, the color on the bottom of the block picked up is white with a black circle, then instead of picking up the next blue block, pick up the blue block preceding the block just picked up. Thus, the test represents a series of going forward and backward until the 24th block is reached.

The performance is watched by the administrator and wrong choices are immediately corrected. The score on the test is the time it takes to go from block number one to block number 24. Smith (10, *p. 14*) found a correlation of 0.65 between this test and a rating of "athletic smartness" of basketball players.

Anderson and McCloy (cited by McCloy, 9, *p. 3*) found a correlation of 0.51 between the composite ratings of 300 girls' abilities in basketball, volleyball, and diving, and this test. Hence this test was considered to be of possible value for measuring the multiple response abilities of baseball players.

Motor capacity: The General Motor Capacity Score (11, *p. 124–27*) was used to measure motor capacity. The score is not designed to denote present ability, but is a means of predicting potential levels which an individual may be expected to attain. McCloy (11, *p. 125*) found that this score has a high correlation with track and field ability, and a correlation of 0.7 with ratings of football and basketball playing ability in high school students.

Analysis of Data

Intercorrelations were computed by the product-moment method (12, *p. 282–88*). See Table 1. Multiple correlations were computed by the Doolittle method in order to determine the relative contribution of the Sargent jump, shuttle run, throwing, blocks test, and "S" test to the criterion (rating). See Table 2.

TABLE 1

Intercorrelations of Test Results and Rating

Test	Rating	Throwing	Sargent Jump	Shuttle run	Squat Thrust
Throwing	0.208				
Sargent jump	0.523	0.169			
Shuttle run	0.247	0.163	0.448		
Squat thrust	−0.008	−0.007	−0.002	0.003	
Blocks	−0.264	−0.249	0.109	0.239	−0.081
"S" test	−0.521	−0.037	−0.334	−0.001	−0.121
Ia. Rev. Brace	0.055	0.016	0.221	0.376	0.381
Motor capacity	0.380	0.381	0.790	0.521	0.296

Test	Blocks	"S"	Ia. Rev. Brace	Mean	Std. Dev.
Throwing				279.07	17.74
Sargent jump				57.23	4.75
Shuttle run				30.20	0.87
Squat thrust				6.28	2.73
Blocks				47.50	11.72
"S" test	0.113			98.90	41.20
Ia. Rev. Brace	−0.059	0.019		14.80	1.85
Motor capasity	−0.014	−0.272	0.429	259.00	12.41

TABLE 2

Multiple Correlations

Variables	R	Code
RO. 12345	0.706	
RO. 1345	0.695	
RO. 145	0.693	0 = rating
RO. 135	0.653	1 = Sargent jump
RO. 15	0.639	2 = Shuttle run
RO. 1234	0.621	3 = Throwing
RO. 134	0.616	4 = Blocks test
RO. 123	0.538	5 = "S" test
RO. 13	0.538	
RO. 12	0.523	

In analyzing the data it was recognized that correlations computed from data obtained from a homogenous group of narrow range would be lower than from a more variable group (13, *p. 195–99*). Since the subjects used in this study were a select group, namely, the varsity baseball squad, the correlations obtained were not numerically high, but would be raised by extending the range.

The high negative correlation found between the Rating and "S" test was rather surprising. Although there was no previous experimentation upon which to base a judgment of the significance of the relationship between the "S" test and baseball ability, it was thought that the space factor should be involved in the ability of a person to see a play develop and to act accordingly.

A partial correlation between the Rating and General Motor Capacity, with the Sargent jump held constant, was practically zero (0.063). This indicates that the Iowa Brace and squat thrusts contribute very little to predicting the criterion.

Using the Sargent jump, "S" test, and blocks test, a multiple regression equation was computed for the criterion in T-score units (Table 3).

TABLE 3

Simplified Formula for Predicting Baseball Ability

T-score = 0.92 Sargent jump(cm.) − 0.08 "S" test (score) − 0.23 Blocks test (sec.) + 16.19

Conclusions

1. From the results obtained, the Sargent jump is the best single measure for selecting baseball talent.

2. That the best economical combination found in this study to predict baseball ability is the Sargent jump, "S" test, and the blocks test.

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Transfer of Motivated Improvement in Speed of Reaction and Movement[1]

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IT HAS RECENTLY been discovered that motivated improvement in the speed of a simple response will transfer to speed up a more complicated movement that is not in itself directly motivated (1). The improvement persists for several weeks before the effect wears off (4). A later study has shown that various types of stimuli, such as sound, light, and electric shock, are all effective in motivating the improvement (2).

In the Henry study, ten experimental subjects exhibited a transfer effect of 12 per cent on a retest of a relatively complicated movement after a period of motivation by applying a mild electric shock during the slower responses of a simpler movement. A group of ten controls showed no statistically significant transfer from unmotivated practice with the simpler movement. The resulting improvement of the experimental group was considered more likely to be due to transfer of the motivation effect than to transfer of learning (1).

According to Henry's hypothesis that it is the motivation effect that is transferred, it would be expected that motivating a movement response of one part of the body should transfer to speed up movement in some other part—for example, motivating a hand response should speed up a foot response. It is the purpose of the present research to create an experimental situation which will provide the necessary data for testing this hypothesis.

In the previously mentioned transfer study, the effect of motivation was found in terms of increases in speed of movement, which included both the reaction and movement components of the total response time. By new additions to his apparatus, Henry determined that the effect of the motivation speeded up both the reaction time and movement time components of a coordinated neuromuscular action. The reaction and movement phases were independent and uncorrelated (2). In view of this lack of relationship between the two components, it is important to ascertain to which component the motivated improvement transfers, or if it transfers to both.

Apparatus and Method

Details of how the subjects are handled in the experiment and a description of the fundamental parts of the apparatus are given in the articles reviewed above (1, 2, 4). Modifications necessary for the present experiment are shown

[1] From the Research Laboratory of the Department of Physical Education, University of California, Berkeley. The writer is grateful to Dr. Franklin M. Henry for invaluable guidance throughout this research.

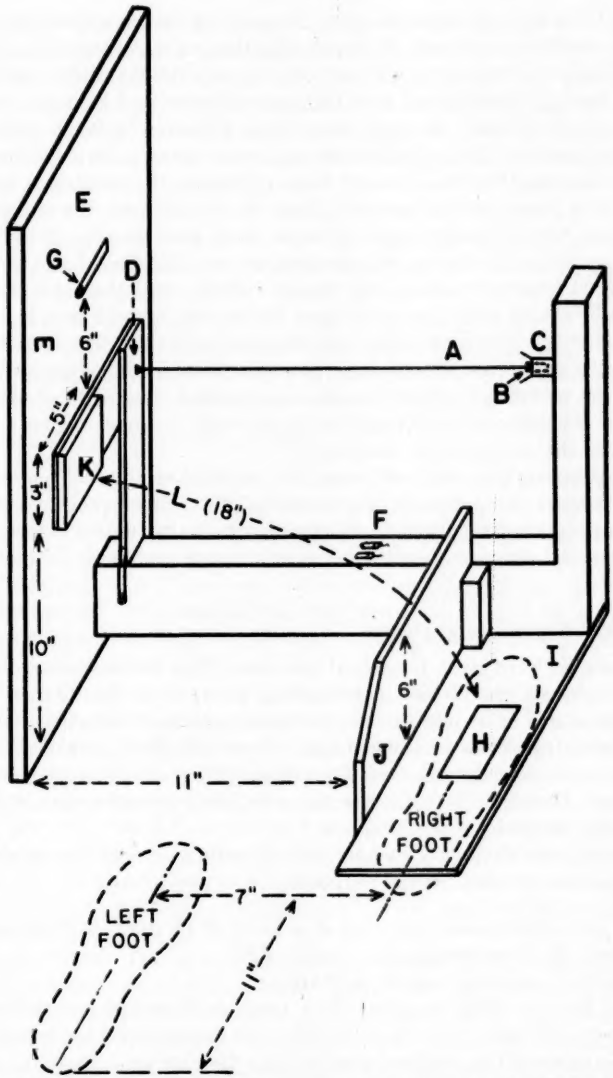

Fig. I. Diagram of the reaction and movement time apparatus, shown in the position to test speed of foot response. When used for hand response, it is turned 90 degrees counter-clockwise and placed on a table so that part E serves as the baseboard. The various parts are as follows:

A—treadle cord	E—hand baseboard	I—foot baseboard
B—plastic strip	F—reaction signals	J—obstacle board
C—friction contacts	G—hand reaction key	K—kick pad
D—hand treadle	H—foot reaction key	L—foot movement

in Figure I. In the first series of tests, S stands above the apparatus with his feet in the positions indicated. Following the flash of a warning light, after an irregular delay of from one to four seconds, the signal light flashes on. S reacts by lifting his right foot up and over the obstacle board and kicks the pad with a left lateral movement, the total path being 18 inches. Lifting the foot has stopped the reaction timer; kicking the pad stops the total time indicator; the difference between the two indicated times represents the movement time.

After being tested in this manner, S sits at a table with the apparatus in front of him, with his fingers resting on the hand reaction key. At the signal, he reacts by lifting his fingers (which stops the reaction timer) and moves his hand forward 6 inches to press the treadle (which stops the total time indicator). As before, flashing the signal light has started both timers; in addition it has started the electronic delay circuit which will turn on the motivating stimulus after a pre-set lapse of time. In order to avoid this stimulus, S must complete the movement faster than his own median time; if he is slower, he will receive the motivating stimulus beginning with the median time and continuing until the movement is completed.

After performing the hand test series, S is retested on the foot movement in order to measure the extent of any transfer effect. Since practice effects or transfer of practice effects might influence the results, a control group must go through exactly the same procedure except for the absence of motivating stimuli.

Subjects and Experimental Design

Forty-four Ss were given the initial foot test. Four of these were discarded in order to equate the 20-man experimental group with the 20-man control group. The source of Ss was various university physical education classes, 48 per cent being from body-building classes, 30 per cent from basketball and the remainder from miscellaneous activity classes. Their age averaged 20 years, ranging from 17 to 26. The experimental and control groups were matched for age, activity, and hour of performance.

The testing was divided into four periods with a one- to two-minute rest between periods for instructional purposes:

1. *Foot Test.* This period consisted of a series of 15 trials, a 30 second rest, followed by 15 more trials for a total of 30.
2. *Hand Test.* A straight series of 20 trials.
3. *Hand Practice.* This consisted of 15 trials, a 30 second rest, followed by 10 more trials for a total of 25. During this entire period the experimental group received the motivating stimuli for the slowest 39 per cent of their responses. The control group received no motivating stimuli.
4. *Foot Retest.* This period included a series of 15 trials, a 30 second rest, and 10 additional trials for a total of 25.

Each S performed the complete experiment of 100 trials in approximately 45 minutes. The experimental group was handled exactly like the controls with the exception that in the hand practice, ten Ss were given a loud sound as a

motivating stimulus and ten were motivated by a mild electric shock applied to the inactive arm, as in the Henry studies (1, 2).

In order to simplify statistical computations from the raw data, each consecutive group of five trials was considered as one trial period. The means for each subject, and thus each group, were computed from the means of all the trial periods within each of the respective testing periods. This method can be justified because when it is used there is no evidence of significant learning in the controls when the hand test is compared with hand practice or when the foot test is compared with foot retest. Nevertheless, in all determinations of the t ratio for changes in the experimental group, the effect of practice (i.e., the control group improvement) was deducted. In this study, a t of 1.72 is significant at the 5 per cent level of confidence and 2.52 at the 1 per cent level (for $N = 20$). These probabilities are based on only one tail of the distribution of t because either no difference or a difference in the wrong direction will disprove the hypothesis of improvement due to motivation.

Experimental Results and Discussion

Reaction Time. The results are shown in Figure II. The control group had a mean reaction time (*RT*) of 0.216 seconds on the hand test and 0.214 seconds on the hand practice period. The means for the experimental group were 0.220 seconds for the hand test and 0.196 seconds for the practice period. This was an improvement of 10.9 per cent, which can be attributed to the motivation since the control improvement was less than 1 per cent. The motivated improvement gave the highly significant t ratio of 6.48 while the control t was only 0.69, which is not significant.

Similar results were found with the foot in the transfer part of the experiment. The means for the control group, before and after the hand practice, showed only a negligible improvement, from 0.275 seconds on the foot test to 0.273 seconds on the foot retest with a t of 0.63. Comparison of the initial test and retest in the experimental group revealed a highly significant improvement of 11.1 per cent, the *RT* decreasing from 0.279 seconds to 0.248 seconds with a t of 8.13, which is highly significant. These figures attest to the reality of transfer of the motivation factor from the hand-reaction time to the foot-reaction time, as the hand practice alone did not cause a significant foot improvement.

Movement Time. The results are shown in Figure II. The control group had a mean movement time (*MT*) of 0.089 seconds on the hand test followed by a drop to 0.088 seconds for the hand practice period. The improvement of 1.1 per cent was not significant. The experimental group had a mean of 0.089 seconds which lowered to 0.081 seconds during the motivated practice period. This amounted to a 9.0 per cent improvement with a significant t of 2.73.

The *MT* means for the foot test and retest in the control group were identical, averaging 0.175 seconds, indicating no practice effect. The experimental group showed a gain in speed, from 0.177 seconds on the initial foot test to 0.168 seconds in the post-motivation, or retest period, the improvement being 5.1 per cent, and t being 2.26, which is statistically significant. Thus, the

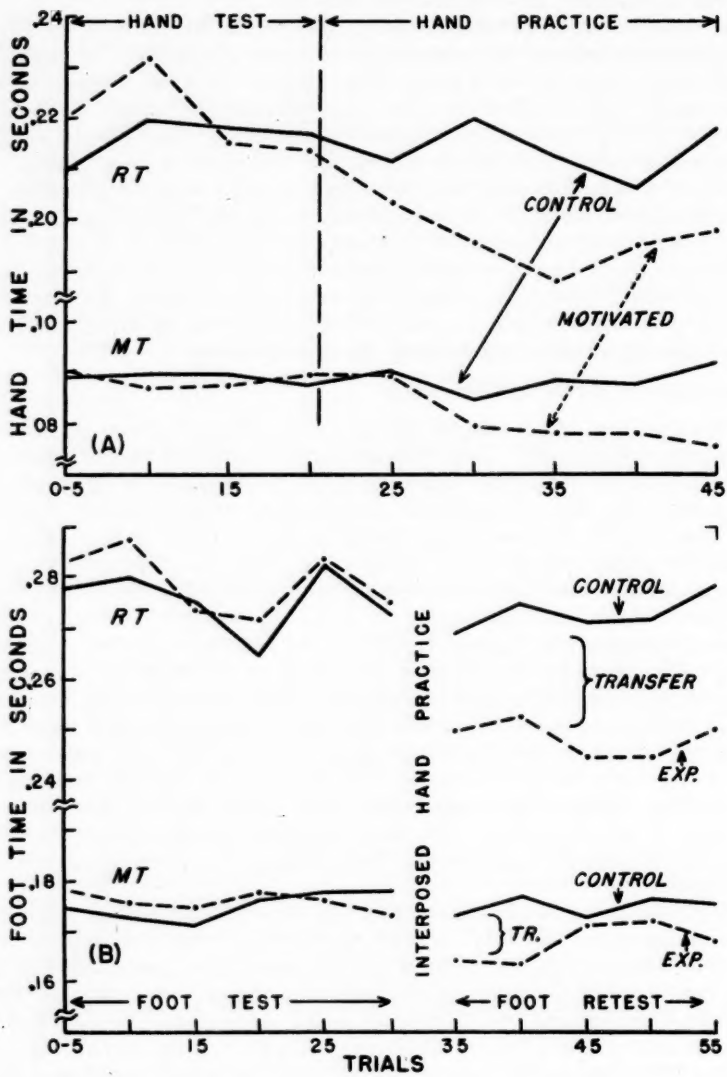

Fig. II. Reaction and movement times. The upper graph (A) gives the results on the hand test and hand practice; the lower graph (B) shows the transfer of motivation to the foot retest in the experimental group.

statistics show that there was no improvement in foot *MT* due to the introduction of practice with the hand, but that there was a significant transfer of motivational improvement to the foot movement when the hand practice was under the influence of motivating stimuli.

Difference in Type of Motivation. In hand *RT* the ten Ss receiving sound as motivation decreased from 0.222 seconds on the hand test to 0.201 seconds on the hand practice for a highly significant improvement of 9.5 per cent, with a *t* of 4.83. The ten shock-motivated Ss improved 12.3 per cent, lowering their hand *RT* from 0.219 seconds to 0.192 seconds, with a statistically significant *t* of 4.47. In foot *RT* the transferred sound motivation resulted in an improvement of 11.4 per cent (0.264 to 0.234 seconds), while the shock-motivated Ss improved 11.2 per cent (0.295 to 0.262 seconds). The gains of both groups were statistically significant with *t* ratios of 5.56 and 5.68 respectively.

The small number of Ss limits the predictive value of the results, but the figures serve to indicate that there is no significant difference in the type of motivation used for causing improvement in *RT*, or in the transfer of such improvement. This result is in accord with other data on the effects of different types of sensory motivation in improving *RT* in a co-ordinated hand movement (2).

In *MT*, the breakdown of the experimental group into sound and shock subgroups discloses somewhat unclear results. The *amount* of directly motivated improvement in hand response was almost exactly the same for the two types of motivation (9.0 per cent and 8.9 per cent), as the *MT* means decreased from 0.085 to 0.077 seconds with sound and from 0.092 to 0.084 seconds with shock. The *t* ratio for the sound improvement was 3.15, which is statistically significant. However, due to greater variability among the individual improvements, the *t* for the shock group was only 1.51 and not significant. The sound-motivated group had a transferred improvement of only 2.3 per cent (0.173 to 0.169 seconds), which was not significant ($t = 0.49$), while the shock-motivated Ss improved their *MT* from 0.181 seconds to 0.167 seconds for a significant transfer effect of 7.7 per cent ($t = 2.47$).

These figures show a significant hand improvement in *MT* due to direct motivation by sound, but no significant transferred improvement in foot *MT*. With direct shock motivation, the improvement in hand *MT* is not significant, but the transferred improvement in foot *MT* is definitely significant. The subsamples are small and differ in variability, which is enough to explain why this secondary part of the study has not given conclusive evidence. The results with *RT* showed no significant difference in the effectiveness of type of stimulus. It is doubtful if the results with *MT* establish any real difference in the effectiveness of the two kinds of motivating stimuli, but if there is any difference, it is in favor of the sound as being the more effective in direct motivation and the shock in the transferred improvement.

Reaction Time and Movement Time Intercorrelations. Observation of the mean results and the nature of the curves (Figure II) indicated that a significant negative correlation might exist between foot *RT* and foot *MT* in the retest of the experimental group after the hand motivation, since *MT* tended to in-

crease when *RT* decreased and vice versa. This observation led to a closer consideration of the foot movement itself and it was realized that the nature of the foot and leg action in the experiment was complicated and required a change of direction after the initial foot release involved in the reacting (*RT*) process.

Particularly in the foot retest after the motivation, some Ss spontaneously gave verbal indication that they were concentrating on the initial part of the foot movement, i.e., they had developed a set toward the *RT* part of the response. It could be assumed that this might result in less attention to the other part of the movement. Since other Ss did not seem to develop this type of set, it could be expected that some would improve *RT* at the expense of a slower *MT*, which would cause a negative correlation. To test this hypothesis, correlations between *changes* in individual *RT*'s and *MT*'s from one trial period to another were computed. This was done between retest trials 6 through 10 and 11 through 15, where the greatest relationship would be expected judging from the changes in mean *RT* and *MT*. The correlation was not statistically significant at even the 5 per cent level, as $r = -0.102$. In addition to this, correlations between *MT* and *RT* scores were computed for each of the 5 trial periods in the foot retest of the experimental group. All the correlations came out negative and non-significant, ranging from -0.074 to -0.405 with a mean of $r = -0.278$. Absence of appreciable correlation between *RT* and *MT* agrees with the results of Henry, who concluded in a recent study that reaction and movement speeds are uncorrelated (2). Although the curves of the means for the experimental group on the foot retest do indicate a negative interrelation, and the correlations of individual *RT*'s and *MT*'s are also negative, the hypothesis is not proved because the correlations are not high enough for statistical significance.

Nature of Transfer. It is well established that motor skills or co-ordinations are highly specific and that practicing one type of co-ordinated movement, as for example a quickening exercise, does not transfer to improve a hypothetical general co-ordination or some other specific co-ordination (3). However, transfer of motivation seems to follow a different principle, as the studies of Henry (1) and Munro (4) have shown that it does occur in two types of hand movement that involve different co-ordinations, when there is no transfer of training.

The present experiment extends these studies to show that transfer of the motivation effect occurs in more widely different co-ordinations, namely, between a simple forward movement of the hand and a more complicated upward-lateral movement of the foot and leg, and under conditions where it is shown that there is no transfer of training.

Summary and Conclusions

Forty male students from university physical education classes were tested as to speed on a hand-co-ordination movement and a foot-co-ordination movement, for the purpose of determining whether motivated improvement in movement of one part of the body transfers to cause improvement in movement of some other part of the body. Half of the subjects served as an experi-

mental group and half as a control group. During a 45-minute testing period, each subject performed 100 trials involving a foot test, a hand test, a hand practice period, and a foot retest. The 20 control and the 20 experimental subjects were tested identically except that during the hand practice, each experimental subject was motivated by being stimulated with sound or electric shock on his slower trials. Half of the experimental group received sound and half received shock so that the two different types of motivation could be compared.

The results showed that motivated improvement in speed of movement in one part of the body (hand) can transfer to cause a significant improvement in speed of a different type of movement in some other part of the body (foot), under conditions where there is no transfer of training. There was a significant motivated improvement of 10.9 per cent in hand reaction time, followed by a significant transfer of the motivation effect resulting in a 11.1 per cent improvement in the foot retest. In the control group the improvements in both the hand and the foot movements were less than 1 per cent and not statistically significant. In movement time, the directly motivated improvement was 9.0 per cent in the hand compared with a 5.1 per cent transferred improvement in the foot, both being significant. The improvements of the control group were not significant. Thus reaction time showed a larger and more significant transfer than movement time. Since the foot retest of the control group did not improve in either reaction or movement times, the results prove that transfer of training failed to occur whereas transfer of motivated improvement did occur.

No appreciable difference was found between sound and shock in causing reaction time improvement either in direct motivation on the hand or in transferred motivation to the foot; in movement time, evidence for differential effects were inconclusive. There was no significant intercorrelation between speed of reaction and speed of movement, or between transferred improvement in reaction and movement.

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Recreational Pursuits in the Old South

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THIS IS A study of the recreational pursuits of the people of the Old South, and of the place of these recreations in the culture of the times. The study is based primarily on original sources—contemporary accounts by travelers and residents of the South.

Previous Investigations of the Subject

There appears to have been comparatively little study devoted specifically to the play life of the ante-bellum South. Dulles,[1] Holliman,[2] and Weaver[3] have considered the games and amusements of Virginia and other southern states as they relate to the total American play scene, but not as a specific area.

Methods Used in the Study

The historical method of research has been used, with the emphasis on primary sources. Accounts of French, British, and travelers in the South, and diaries and reminiscences of ante-bellum ladies and gentlemen present a picture of the recreations and amusements of the 17th, 18th, and early 19th centuries.

A few secondary sources were consulted, among which the following gave much valuable information: Ewing's *Sports of Colonial Williamsburg*,[4] Mary Stanard's *Colonial Virginia*,[5] and Philip Bruce's *Social Life of Virginia in the Seventeenth Century*.[6]

Limitations

In a rather arbitrary manner, geographical limits for the study were set to include the regions popularly termed the "Old South" and the period of time included was from the coming of the white settlers to Jamestown in 1607 to the "War between the States" in the 1860's.

The study is further limited to a consideration of the recreational life of the white man.

A final, and important, limiting factor is that this investigation does not purport to be of a conclusive nature. It has been, and is, solely a pleasurable hobby of the author!

[1] Dulles, Foster Rhea. *America Learns to Play*. New York: D. Appleton-Century Company, 1950.

[2] Holliman, Jennie. *American Sports* (1785–1835). Durham: The Seeman Press, 1931.

[3] Weaver, Robert B. *Amusements and Sports in American Life*. Chicago: University of Chicago Press, 1930.

[4] Ewing, William C. *Sports of Colonial Williamsburg*. Richmond: The Diet Press, 1937.

[5] Stanard, Mary Newton. *Colonial Virginia, Its People and Customs*. Philadelphia: J. B. Lippincott, 1917.

[6] Bruce, Philip Alexander. *Social Life of Virginia in the Seventeenth Century*. Lynchburg: J. P. Bell, 1927.

Summary of Findings

The recreational pursuits of the inhabitants of the Old South, according to the accounts of partial and impartial observers, were not far different, we believe, from those of the present residents of Virginia, Alabama, or Louisiana. The early Southerner danced, hunted and fished, played cards (sometimes for money!), enjoyed himself at picnics and barbecues, and played games during his youth that were not unlike our modern baseball, bowling, and tag games. He was a spectator at sporting events, for which he paid admission or bought subscriptions, and sometimes was criticized for gambling at these sporting occasions!

Let us examine more closely some of these activities.

1. *Dancing.* According to most biographers of ante-bellum customs, dancing was an important part of the educational and social life of gentlemen and ladies. Balls and dancing parties filled the nights—and even the days—of the Virginians, the New Orleans residents, and the planters and backwoodsmen of Georgia, Alabama, and Mississippi.

John Kells wrote from Hampton, Virginia, to friends in London in 1795 that "dancing is the chief diversion here",[7] and Philip Fithian, the famous English tutor for the Carter family of Virginia, said that "any young gentleman traveling through the Colony is presumed to be acquainted with Dancing, Boxing, Playing the Fiddle, and Smallsword, and Cards".[8]

In Charleston, South Carolina, in the 1780's "a French dancing master was the promoter of [a dancing hall]; the necessary amount was advanced by the first minister of the town who had no hesitation in a matter of furthering the pleasure of his parishioners . . . in the New England areas the bare thought of such a thing would have disgraced any minister."[9]

In New Orleans, most travelers noted quickly the love of dancing of the French settlers. Stoddard[10] notes that, "They [the Louisianians] are particularly attached to the exercise of dancing, and carry it to incredible excess . . . this amusement which usually commences early in the evening and seldom is suspended til late the next morning." Ashe[11] in 1809 wrote that "though the places of amusement are separate in the city for the distinctions in society, still there is an assembly held every Sunday evening at the Bayou [New Orleans]. . . . The Spanish women excel in the waltz, and the French in cotillions." Fithian[12] tells us that in 1774 "Squire Lee [Richard Lee of Westmoreland County] is preparing to make a splendid ball, which is to last four or five days. . . . We set out from the Carter's at two o'clock . . . about seven the Ladies and Gentlemen began to dance in the Ball-Room—first Minuets one round; Second

[7] Stanard. *Op. cit.*, p. 150.

[8] Fithian, Philip Vickers. *Journal and Letters* 1767–1774. Princeton: University Library, 1900, p. 287.

[9] Schoepf, Johann David. *Travels in the Confederation*, 1782–1784. Philadelphia: William J. Campbell, Vol. II, 1911, p. 168.

[10] Stoddard, Major Amos. *Sketches, Historical and Descriptive of Louisiana*. Philadelphia: Matthew Carey, 1812, p. 321.

[11] Ashe, Thomas. *Travels in America*. London: Richard Phillips. 1809, p. 315–316.

[12] Fithian, *Op. cit.*, p. 83, 95.

Giggs; third Reels; and last of all country-dances . . . the Music was a French-horn and two violins."

Other mentions of some of types of dancing follow: Longstreet,[13] writing of Georgia customs about 1800 says, "Dancing was really, in those days, a merry-making business. Except for the minuet which was introduced only to teach us the graces, and the conga, which was only to chase away the solemnities of the moment, it was all a jovial, . . . amusement. . . . We had none of your mathematical cotillions; none of your immodest waltzes; none of your disgusting gallopades. . . ."

James K. Paulding[14] visited the Virginia springs in 1817, and found that "they sometimes dance of evenings. . . . It so happened that a servant of the gentleman here was adept in playing Virginia reels, which are true native-born dances, and in my mind infinitely superior to cotillions and waltzes."

Dancing lessons and classes were conducted in many places both for children and adults. As early as 1737, William Dering announced in Virginia that he "could teach all gentlemen's sons to dance in the newest French manner."[15]

The record of the business transacted by the Board of Visitors of the College of William and Mary in March 1716 shows that "On the petition of William Levingston, leave is granted him to make use of the lower room at the South end of the College for teaching the scholars and others to dance until his own Dancing School in Williamsburg be finished."[16]

Fithian "dismissed the children [from their regular classes on November 7, 1773] on account of Mr. Christian's Dance." Mr. Christian was the Dancing Master, and Fithian further notes that Mr. Christian is punctual and rigid in his discipline, so stout indeed that he struck two of the young misses for a fault in the course of their performance.[17]

Harriet Martineau,[18] visiting Charleston in 1838, wrote that "hundreds of little people of Charleston were preparing for their childish pleasures, their merry dancing-schools, their juvenile balls."

A French traveler, Baron de Montlézun,[19] was bored by a "bal des écolières" which he attended in Charleston: bored by the ordeal of watching children dance for five hours in a manner in which he says the movement of the feet was made at the sacrifice of neglecting arms, body, and head.

Even as in the 20th century, in some of the more remote sections of the South, religious scruples and social taboos caused criticism of dancing by the clergy and other inhabitants.

But an early Virginian said "in the Valley [of Virginia], which was settled chiefly by Scotish, Irish, and Germans, who were supposed to have had stricter

[13] Longstreet, A. B. *Georgia Scenes*. New York: Harper and Brothers, 1840, p. 119.

[14] Paulding, James K. *Letters from the South*. New York: James Wastburn and Company, 1817, Volume I, p. 232.

[15] Stanard. *Op. cit.*, p. 143.

[16] Ewing. *Op. cit.*, p. 35, 36.

[17] Fithian. *Op. cit.*, p. 53, 63.

[18] Martineau, Harriet. *Retrospect of Western Travel*. London: Sounders and Otley, 1838, Volume II, p. 87.

[19] de Montlézun, Baron. *Voyage Fait dans les Années* 1806 *et* 1817 *de New York à la Nouvelle-Orléans*, p. 206.

ideas in regard to worldly pleasure, dancing three and four handed reels and jigs was the principal amusement of the young people. They also had a dance called the 'Irish Trot'."[20]

Bishop William Meade,[21] however, noted that in Albemarle County, Virginia, "Rev. Charles Clay . . . preached another [sermon] . . . and concludes with a faithful warning against the profanating of Christmas Day by fiddling, dancing. . . ."

The Reverend Mr. Timothy Flint criticized the people of Arkansas in the 1820's "who came to the place of worship arrayed in their ball-dresses and went directly from worship to the ball. . . ."[22]

James Stirling[23] said in 1857 that "promiscuous dancing is still sin abhored in the Valley of Virginia; the good Presbyterians of Virginia, stick by the letter of the law, and hold in orthodox adherence the iniquity of the reel and the more abomination of the polka. . . ."

2. *Outing Activities.* A second class of activities practiced both for necessity and pleasure were those of the out-of-doors—hunting, fishing, riding . . . enjoying oneself at a picnic or barbecue, and similar amusements.

Robert Beverley,[24] in the *History of Virginia* published in 1722, wrote that "they [the Virginians] have Hunting, Fishing, and Fowling with which they entertain themselves in an hundred ways. . . . They have many pretty devices besides the Gun to take Wild Turkey. . . . The Indian invention of Weirs in fishing, is mightily improved by the English, besides which they make use of seins, trolls, casting nets, setting-nets, hand-fishing, and angling, and in each find abundance of diversion . . . another sport, which the young people take great delight in, and that is the hunting of wild horses."

William Byrd,[25] of Westover, in his diary of the years 1709–1712 tells of "going into the river [swimming?] and of hunting for wild pigeons on his estate with bow and arrows."

Philip Gosse,[26] writing of sports in Alabama in the early 1800's said, "In the comparative solitude of the vast forests . . . the dwellings are few and remote from each other; many of the . . . amusements which belong to the crowded inhabitants of Europe are here unknown. Self-defense, and the natural craving for excitement compel [man] to be a hunter. . . ."

Gosse also describes a number of rural Alabama pastimes which developed as tests of skill in using the rifle: (1) "threading the needle," in which the

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[20] Stanard. *Op cit.*, p. 144.

[21] Meade, Bishop. *Old Churches, Ministers and Families of Virginia.* Philadelphia: J. P. Lippincott, 1857, pp. 48–49.

[22] Flint, Timothy. *Recollections of the Last Ten Years.* Boston: Cummings, Hilliard and Company, 1826, p. 264.

[23] Stirling, James. *Letters from the Slave States.* London: John W. Parker, and sons, 1857, p. 330.

[24] Beverley, Robert. *History of Virginia.* London: F. Fayran and J. Clarke, 1722, p. 272–276.

[25] Byrd, William. *The Secret Diary of William Byrd of Westover,*—1709–1712. Richmond: The Dietz Co. Press, 1941, p. 206, 348.

[26] Gosse, Philip Henry. *Letters from Alabama.* London: Morgan and Chase, 1859, pp. 130–134.

marksman attempted to drive a bullet into a small hole in a board without touching it; (2) "Driving the nail," where the rifleman fired at a nail so as to hammer it into a tree; and (3) "Snuffing the candle," by using a rifle to snuff a burning candle which was placed on a stick at some distance.

Thomas Jefferson[27] once wrote to a friend, "Give about two [hours] each day to exercise. . . . As to the species of the exercise, I advise the gun . . . let your gun, therefore, be the constant companion of your walks. . . ."

David Ramsey,[28] in his *History of South Carolina*, published in 1858, said: "Hunting, both as a business and a diversion has always been useful and fashionable in Carolina. . . . Children are taught by their [parents'] example, and early equipped with a dog, a gun and a horse. . . ."

As to fishing, the 1827 edition of *The American Farmer*, an early periodical devoted to agriculture and rural sports, gave some tips to fishermen. "It may not be generally known to anglers that by besmearing their bait with asafedida, or other aromatic, fish from considerable distance around will seize it with delight."[29]

James Paulding[30] went trout fishing in the southern Appalachians some time before 1817, having "borrowed a fishing rod from a miller near by," but he found that "trout do not abound greatly in the mountain streams in the South, as they do in the North."

The Western explorer, Cuming, went fishing with a plantation owner near Natchez, Mississippi, early in the 1800's with "rod and line," and he noted that his host "caught some catfish."[31]

Professor J. H. Ingraham fished near Nashville, Tennessee, in the 1850's with his host who taught him to "cast his line thirty feet," into "deep pools. . . ."[32]

Other outing events included the barbecue, which Isaac Weld observed "in this part of the country bordering on the James River" before 1820,[33] and Henry Knight found that the Virginians "sometimes shoot at a target for the privilege of being the guest at a barbecue or fish fry."[34]

Charles Lanman[35] wrote that "it is quite certain that it [the barbecue] was first introduced into this country by the early settlers of Virginia."

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[27] Jefferson, Thomas. Quoted from the *Jeffersonian Cyclopedia*. Edited by John P. Foley. New York: Funk and Wagnalls, 1900, p. 318.

[28] Ramsey, David. *History of South Carolina*. Newberry: W. J. Duffie, 1858, Volume II, p. 276.

[29] *The American Farmer, Op. cit.*, Volume IX, p. 111.

[30] Paulding. *Op. cit.*, Volume II, p. 3–4.

[31] Cuming, F. Sketches of a Tour to the Western Country. Found in *Early Western Travel*—Edited by Reuben Gold Thwaites. Cleveland: Arthur Clard, 1904, Volume IV, p. 327.

[32] Ingraham, Professor J. H. *The Sunny South: or the Southerner at Home*. Philadelphia: G. G. Evans, 1860, p. 166.

[33] Weld, Isaac *Travels Through the United States of North America and the Provinces of Upper and Lower Canada*. London: John Stockdle, 1820, p. 140.

[34] Knight, Henry. *Letters from the South and West*. Boston: Richardson and Lord, 1824, p. 66.

[35] Lanman, Charles. Haw-Ho-Noo: From *Records of a Tourist*. Philadelphia: Lippincott, Granbo and Company 1850, p. 94.

Little mention is made of swimming as a sport by the early colonists, but Holliman[36] quotes from the Carolina Sentinel of Newbern, North Carolina, of August 1827, that "Dr. Lieber, a German at Boston, is able in a few lessons to teach any person to swim. The unspeakable importance (to say nothing of the pleasure) of being able to sustain ones self in the water, would, it is believed, find pupils in abundance for any competent person who would establish a school in our city. . . ."

3. *Card and Table Games.* Many of the participants and observers of early Southern recreation mention various card and table games, which often were used to while away the evenings in the large plantation houses, or as games of chance in taverns, on steamboats, or in commercial gambling establishments.

Robert Baird[37] in 1832 writes that "another practice too prevalent on . . . steamboats is that of playing cards. It is true that it is generally for amusement, for the well-regulated boats profess not to tolerate gambling."

Bishop Henry Whipple[38] notes in his diary for 1844 that in Mobile, Alabama, he "saw the first specimens of gaming which is so fashionable throughout the western world. A game they call 'poker' appeared to be the game most played. . . ."

William Byrd played *piquet*, a card game of the 17th century. He also played *whist*, and *basset*, which was a game resembling the later game of *faro*. He noted in his diary the sums of money which he lost at these games. Billiards was also played at Westover by the men *and* the ladies.[39]

Cuming found billiards, chess, and backgammon being played in Lexington, Kentucky, in the coffee houses before 1820.[40]

Henry Howe[41] stated that in the early days of Washington College [Washington and Lee], the students played "cards, backgammon, . . . and even marbles."

Peregrine Prolix found a "bagatelle table freely used" at Warm Springs, Virginia, in the 1830's.[42]

In 1804 Major Amos Stoddard felt that the French inhabitants of Louisiana were very fond of games of hazard" . . . they escape from the ballroom to cards, from cards to billiards, from billiards to dice."[43]

Joseph Baldwin mentioned a chess game between Thomas Jefferson and the French minister which lasted for three years.[44]

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[36] Holliman. *Op. cit.*, p. 93.

[37] Baird, Robert. *View of the Valley of the Mississippi.* Philadelphia: H. S. Tanner, 1832, p. 324.

[38] Whipple, Henry Benjamin. *Bishop Whipple's Diary,* 1843–1844. Minneapolis: University of Minnestoa Press, 1937, p. 84.

[39] Byrd. *Op. cit.*, p. 12, 15, 24, 229, 245.

[40] Cuming. *Op. cit.*, p. 188.

[41] Howe, Henry. *Historical Collections of Virginia.* Charleston: William R. Babcock, 1852, p. 435.

[42] Prolix, Peregrine. *Letters Descriptive of the Virginia Springs.* Philadelphia: H. S. Tanner 1837, p. 29.

[43] Stoddard. *Op. cit.*, p. 332.

[44] Baldwin, Joseph, *The Flush Times of Alabama and Mississippi.* Americus, Georgia: Americus Book Company, 1853, p. 129.

4. *Racing and Other Spectator Sports.* The South from early times had its commercial sporting events, which drew many spectators.

Horse racing was the most widespread and the most highly patronized of all this group of recreations.

Ewing[45] says that the first race horse was brought to Virginia between 1730 and 1740 by Samuel Gist of Hanover, and Ramsey[46] says that Charleston, South Carolina, had a race course built by private subscription in 1754 "to encourage the raising and improving of the breed of good horses."

John Smyth,[47] in 1784, told of the "races at Williamsburg twice a year, that is, spring and fall . . . adjoining to the town is a very excellent course . . . there are races established annually at almost every town and considerable place in Virginia."

An editorial in *The American Farmer* of 1824 encouraging the growth of "Field Sports," quoted John Marshall as saying, "Virginia must be indebted to them [the Sports of the Turf] for her cavalry." The editor added that it was understood that Thomas Jefferson "could never prevail on his horse to take him past a race course, without calling to enjoy the exhilerating enthusiasm which a scene so animated never fails to kindle."[48]

In Alabama, Baldwin[49] found the young men of Randolph County gathering for "horse-racing, shooting-matches, cock-fighting . . ." and Tyrone Power wrote of going to the race-course in Natchez.[50]

Flint[51] said that "in Louisiana betting and horse racing are amusements eagerly pursued and often to the ruin of the parties. A Louisianian will forego any pleasure to witness and bet on one horse race. Even the ladies visit these amusements and bet with the gentlemen."

Another spectator sport observed by Ashe[52] was "rough and tumble fighting." He said that "few nights [in Virginia] elapsed without the exhibition of this new gymnastic. . . ."

Smyth[53] found the Virginians "all excessively attached to every species of sport, gaming, and dissipations, particularly horse racing, and that most barbarious of all diversions . . . cock-fighting." La Rouchefaucauld[54] agreed with him in his statement that "gaming is the ruling passion of the Virginians at cards, dice, billiards; at every imaginable hazard they lose considerable sums . . . yet a law of the State enacted in 1792 expressly prohibits all games of hazard, all wagers at horse-races, or cock-fights of which the Virginians are passionately fond."

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[45] Ewing. *Op. cit.*, p. 2.
[46] Ramsay, *Op. cit.*, p. 224.
[47] Smyth, J. F. D. *A Tour of the United States of America.*
[48] *American Farmer. Op. cit.*, Volume VI, 1824, p. 270.
[49] Baldwin. *Op. cit.*, p. 122.
[50] Power, Tyrone. *Impressions of America.* Philadelphia: Lea and Blanchard, 1836, p. 128.
[51] Flint, Timothy. *Op. cit.*, p. 324.
[52] Ashe. *Op. cit.*, p. 85.
[53] Smyth. *Op. cit.*, p. 67.
[54] Duke de la Rouchefaucauld Linacourt. *Travels through the United States of North America and Upper Canada.* London: T. Davis, 1799, Volume III, p. 77.

Jefferson wrote "Gambling corrupts our dispositions, and teaches us a habit of hostility against all mankind."[55]

5. *Active Games of Childhood and Youth, and Various Miscellaneous Forms of Play.* It may be that few travelers in the South took time to watch children's play because of the more fascinating affairs of the adults—or it is possible that children and youth did not play many games different from those of their parents. At any rate, we find comparatively few references to such activities in the observations of the travelers or in the diaries and reminiscences of the settlers of the region.

Ewing writes of the playing in Colonial Williamsburg of horseshoes and quoits, of a game called *Pall Mall* which resembled croquet, of battledore and shuttlecock, of *Trap Ball* [which was a possible forerunner of "Old Cat"], and of various bowling games.[56]

Fithian wrote in 1767 that he went from Virginia to Baltimore for some "Buff-Ball," but gave no description of the game.[57]

Bruce writes that "the chief amusement of the Virginians of the 17th century was the game of ninepins, played in either alleys specially built for that purpose or in long rooms in private residences." As early as 1636 William Ward of Accomac County, Virginia, is found participating in games of this type [*Accomac County Records, 1632–40,* p. 59].[58]

William Byrd mentions playing at cricket and nine pins at Westover before 1712.[59]

According to Holliman,[60] a notice was carried in the Savannah *Daily Republican* in 1817 telling the members of the *Golf Club* of the postponement of their regular meeting.

Before 1824, Henry Knight[61] wrote of watching "at some cross-roads, or smooth shaven greens, . . . a wooden-wall high and broad as the side of a church, erected for men to play ball against." Was this early basketball?

Ramsey[62] noted that in early days in South Carolina "ball playing and rifle-shooting are added [to the dancing]. . . . Through the interior parts of the State . . . ball-alleys are common and much frequented by the young men. . . ."

Peregrine Prolix[63] found ten-pin alleys at Warm Springs, Virginia, for the amusement of the guests as early as 1830.

Samuel Mordecai told of the game of "shovelboard" being played at Goddiva Spring, Virginia.[64]

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[55] Jefferson, Thomas. Letter to Martha Jefferson—quoted in *Jefferson Cyclopedia. Op. cit.,* p. 372.

[56] Ewing. *Op. cit.,* pp. 25–27.

[57] Fithian. *Op. cit.,* p. 49.

[58] Bruce. *Op. cit.,* p. 193.

[59] Byrd. *Op. cit.,* p. 27, 47.

[60] Holliman. *Op. cit.,* p. 71.

[61] Knight, Henry. *Op. cit.,* p. 65.

[62] Ramsay. *Op. cit.,* p. 227.

[63] Prolix. *Op. cit.,* p. 29.

[64] Mordecai, Samuel, *Richmond in By-Gone Days.* Richmond: The Dietz Press, 1860 (republished, 1946), p. 220.

Longstreet tells of a game popular with boys in 1790 at Eastertime. It was called "peeking" Easter eggs, and consisted of throwing dyed Easter eggs against the eggs belonging to the other boys; the one whose eggs were broken lost the game.[65]

A game akin to "shinny," called *bandy*, was popular along the southeastern states. According to Coon,[66] in the Stokes County, North Carolina, School in 1808, ten lashes was the penalty for playing *bandy* at the school. It is interesting to note that at the same school four lashes were given if boys and girls played together in any game.

A little later, Cunnyghame watched a game in New Orleans which, to him, resembled tennis. It was played by the Creoles on a public square, each player having two small racquets with which he tried to hit a ball through a paper target. Cunnyghame says he believes that it was borrowed from the Indians of Canada.[67]

Ebenezer Davies saw "forty or fifty boys in the square playing cricket [in New Orleans]."[68]

Stanard is convinced that "many of the quaint ring games, singing, kissing and counting games enjoyed by boys and girls of earlier days, with others, such as 'Blind Man's Bluff', 'prisoner's base' . . . were legacies from colonial children [of Virginia]."[69]

Burke tells of seeing children in Georgia "trundling the hoop, throwing the ball, jumping the rope . . ."[70]

Conclusions

1. The type of play activities engaged in by the people of the Old South was not far different from that of most Americans today.

2. Dancing appears to have been a highly popular recreation from Virginia to Florida. The literature of the times mentions the waltz, the cotillion, the minuet, the gigue, the reel, and the country dance. In some of the more conservative areas of the hill country, religious scruples banned the dance as a recreation form.

3. Backwoods and plantation life naturally favored wide interests in outing activities such as hunting and fishing. Contests involving feats of skill with the rifle also were popular in the far South.

4. Very little mention of swimming as a recreational activity appears in the literature.

5. Card and table games were popular home and tavern recreations all over the South.

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[65] Longstreet, *Op. cit.*, p. 74.

[66] Coon, Charles. *North Carolina Schools and Academies.* Raleigh: Edwards and Broughton 1915, p. 763.

[67] Cunnyghame, Lt. Col. Arthur. *A Glimpse at the Great Western Republic.* London: Richard Bentley, 1851, p. 223.

[68] Davis, Ebenezer. *American Scenes and Christian Slavery.* London: John Snow, 1849, p. 65.

[69] Stanard. *Op. cit.*, p. 115.

[70] Burke, Emily. *Reminiscences of Georgia.* Oberlin, Ohio: James M. Fitch, 1850, p. 242.

6. Spectator sports of horse racing, cock fighting, and wrestling were engaged in, and wagered upon, by many Southerners.

7. The comparatively meager references to the active games and play of children and youth cause one to wonder if parents disapproved of such activities generally. It is true that games such as bowling, battledore and shuttlecock, tag games, and cricket were popular in some areas. Perhaps additional investigation into this area would reveal that there was wider participation in these activities than is noted in this paper.

The Professional Football Player: His Vocational Status

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THE PRIMARY purpose of this study was to provide guidance materials for physical educators who must counsel young men desirous of playing professional football. Almost 40 per cent of the players in the professional league were physical education majors. Physical educators, many of whom enjoy close relationships with athletes because of the nature of their work, have the responsibility of guiding some of these men without recourse to authentic and informative literature in the field. College students, asking for advice as to whether or not they should play professional football, cannot receive any real satisfaction because this information is lacking.

Other Purposes

There was also an obligation to the professional football player, the prospective professional, the public and the game itself, to present the professional sport in a factual and revealing light. Many people tend to stereotype the professional football player as a brutish, slow-witted individual devoid of cultural polish and capable of making a living solely by selling his body. Others have a fixed picture of a glamorous god leading a fascinating life while marking time all week long for that one appearance on Sunday for which he receives a fabulous stipend. Both are trite conceptions founded on hearsay, or on acquaintance with one or two atypical professionals. Glamorized literary accounts of the professional game and its players also contribute to these misconceptions.

This study further served the purpose of allowing the professional player to voice his opinion and to be heard. As far as it is known, this is the first opportunity the professional has had to speak in his own behalf concerning the game and its environment. The professional football player, like the labor leader, can truly be classified as a recent phenomenon, the product of the 20th century. This study, therefore, provides information about the still growing and comparatively young vocation of professional football.

Finally, this document may also serve to ameliorate the conditions under which the professionals play the game. Some reforms in the game, similar to the ones recently enacted for their baseball brethren, and reviewed elsewhere in this article, certainly should be studied with a view to adoption by the National Football League.

Professional football has grown in stature, approximating that of professional baseball as a means of livelihood and as a stepping stone to permanent careers in other fields. The willingness of college coaches to enter the professional ranks

is an indication of the growing stability of the game. College athletes are increasingly becoming aware of professional football as a means of livelihood. The professional league is using the colleges as its main recruiting ground for player personnel. Today many ex-professional players and coaches are employed in schools and colleges throughout the country.

The study was concerned only with the National Football League, which is an amalgamation of the National Football League and the defunct All-America Conference. Further, the study was concerned only with the professional football player today. It did not attempt any comparisons with players of previous years.

Procedure

An interview schedule was developed to gather information that would answer some pertinent questions on the vocational status of professional football players. This schedule was used as a basis for obtaining needed information through informal and intimate interviews. It was felt that attitudes could best be studied through personal interrogation. Preliminary contact was made with 25 active players in order to explain the nature of the study and to request their co-operation. Because of the professional playing experience of the interviewer, access to the source of information was less difficult than might have been the case of an investigator considered to be an outsider by professional football players and owners.

These interviews preceded 530 questionnaires that were mailed in April 1950 to players who had been active in both leagues in 1949. The questionnaire was based on knowledge gained and information received from the interview schedule. Completed questionnaires were received from 393 players, a response of slightly better than 74 per cent. The 74 per cent response represented the 100 per cent sample.

The questionnaire listed 49 items which would return information dealing with the players' educational, geographic, and socio-economic backgrounds, reasons for entering professional football, salary and security, health and accident hazards, relation of post-football occupation to major studies in college, the extent to which professional football did or did not aid players in seeking outside employment, attitude of the players toward the professional sport, advantages and disadvantages of the game, and plans for the future. Many of these items were inter-correlated.

Digest of the Study

The average professional football player today is 26 years old, slightly better than 6 feet in height, and weighs about 207 pounds. The professional sport is definitely not a small man's game.

Most professional football players were born in the Midwestern and Middle Atlantic States. The majority of the players received their high school education there, and they reside in those areas at the present time. However, the colleges of the Midwest and South are the main recruiting grounds for the

professional league because most of its players attended colleges in those areas. Ninety-eight per cent of the professional football players received their high school diplomas while 68 per cent received college degrees. All but six professional players attended college.

At the time the players first entered the professional ranks, the median salary of the fathers of these athletes was $4,240, while the semi inter-quartile range was $3,000 to $5,000. The players first began competing professionally for the following reasons in the order of their importance: to gain football coaching experience; to save money; for personal satisfaction; for love of the game; and to acquire money specifically for a home, a business, or professional advancement. Few entered the game because they were jobless and in need of money.

The salary for professional players ranges from $4,000 to $20,000. The median salary for all players is $6,840, while the semi inter-quartile range is $6,000 to $8,000.

Eighty-five per cent of the players are signed to standard league contracts which include the release clause. This type of contract does not guarantee employment for the player, because the club has the power to release the player at any time. It is this release clause which creates insecurity and anxiety for the professional. Only the season contract, which excludes the release clause, guarantees the player a job for the entire season. Only 15 per cent of the professional players enjoy these seasonal agreements.

Significantly, the athletes who profit from these seasonal contracts are the ones who need them least because they are in greater demand. The interview data indicate that the ideal bargaining position for a prospective professional would be for him to be a highly talented football player of All-America prominence; Caucasian, Anglo-Saxon, whose father is in an upper income group, single, and with no particular desire to play because of the possibility of lucrative employment elsewhere.

The Selective Player Draft is the process by which a constant influx of college talent is maintained for the professional sport. Of 2,000 or more college seniors who are eligible annually to participate in professional football, only about 360 are chosen by the 12 professional teams. Of those rookies who go to training camp, one of every three makes the professional grade. Data indicate that a $33\frac{1}{3}$ per cent turnover in player personnel may be expected in the professional league annually. There is no stepping stone to success in professional football as in the case of minor league experience in baseball; the football player "makes" the squad on the first attempt, or he is out.

The player who is drafted by one of the professional clubs may negotiate only with that club for his services because the player draft eliminates free competition for athletes. The player cannot sell his services to the highest bidder. In short, he does not have any bargaining powers, and he must play for the club that drafted him, and at its terms, or not compete at all.

The club further exerts its control over the player by means of the reserve clause in the contract which the player signs. In effect, the reserve clause states that the club has the right to a player's services for the season after the

one for which he signs a contract. This means that the player is somewhat akin to a peon since he cannot play for any other team without the club's consent.

Even without the reserve clause in player contracts, it is open to question if the good player would really be free to sell his services to another club in the league because "gentlemen's agreements" among club owners to refrain from hiring each other's players without consent is a reality accepted by most players. Some critics contend that professional football may be interstate commerce and a monopoly which conspires to restrain free trade; a contention which has not as yet been proved.

A little more than 50 per cent of the players who enter the professional ranks play only one or two years. The median is almost two years and the semi inter-quartile range is one to three years.

Injuries are common occupational hazards of the game. However, 79 per cent of the professionals do not feel that injuries received in the professional sport would have an injurious effect on their well-being in later life. If players are hurt during the season, the clubs continue to pay the players' salaries. All professional football players are covered by workmen's compensation laws, but not all of them are cognizant of this fact. Professional players are legally entitled to unemployment insurance in the off season.

Career continuity in professional football is almost non-existent except for those who expect to coach football. A postal survey of the various intercollegiate conferences indicates that the professional football player is in a favorable position to secure future coaching positions in the schools and colleges, especially if he is qualified academically. Ninety-five per cent of the various conference secretaries expressed this positive attitude toward professional players. Five per cent gave neither a positive nor negative response, replying that the subject had never been raised in their leagues and that a ruling had not been effected on the question as yet. Those players who do not expect to coach football will find the professional game a deterrent to their ultimate careers.

Off-season employment which will lead to permanent work is difficult to find because employers do not wish to hire men who will leave them each football season, which lasts from July 15 to December 15. The players indicate that playing professionally to acquire business contacts is wishful thinking rather than actual truth. Sixty-four per cent of the players said that professional football had not helped them acquire a good, steady job.

Further, although there are some exceptions, professional football does not mix easily with post-graduate education and preparation for the professions. There does not seem to be any marked connection between the players' major studies in the colleges and their off-season jobs, nor does there appear to be any great relationship between the players' major studies and their plans for the future.

The professional player, though not a migratory worker, finds it difficult to settle down. In many instances, married men live away from their families because moving is difficult and expensive. This disadvantage, in a sense, creates what some professionals consider an advantage—the development of an intimate relationship among the players that is founded on special living and

working conditions. This intimacy is shared even with the coach and the owner. Whereas the teacher-pupil relationship between coach and player is more prevalent in the college situation, the man to man relationship is more predominant in the professional environment. The player's relationship with the owner of the professional club is generally intimate because the owner maintains close rapport with his players, either through personal contact, or through one of his executives.

Most professional players treat representatives of the press, radio, and television with cautious friendliness because they are well aware of the power these reporters can wield in molding the opinion of the football public. The professional's relationship with the public generally depends on the team's success and his own ability. In a sense, he is a public figure and sometimes must accept the penalties of that status. For example, he is called upon frequently to give much of his time at public functions, to appear on radio and television shows, and otherwise serve to advertise the game.

The advantages of playing the professional game in order of their importance, according to the players, are: general financial gain; business contacts and publicity; coaching experience; social contacts; personal development and experience; satisfaction and prestige; specific financial gain for a home or a business; travel and education; free time; and social acceptance. Many players indicated that they played professionally because they loved the game.

The disadvantages include: the risk of physical injury; being away from home; insecurity of the job; retarding or interfering with lifetime career; seasonal job; bad environmental conditions; no future in the job; interruption of education; and too much work and travel.

Professional football players hold a highly favorable attitude toward the professional sport. Seventy per cent of the players would allow their sons to compete professionally if they had talent, and ninety-four per cent of them would play again if they had it to do over. In general, the players feel that playing professional football is worthwhile.

In the opinion of the players, the conditions under which the professional football player competes may be bettered through the implementation by the league of a six-point program which would include the establishment of a $5,000 minimum salary as in major league baseball; the limitation of salary decreases from one year to the next; a guarantee of seasonal employment once the league season begins; a modified annuity and insurance plan similar to the one enacted for professional baseball players; player representation; and the adoption of a league policy to help players and their families find suitable and moderate living quarters during the football season.

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Independence of Reaction and Movement Times and Equivalence of Sensory Motivators of Faster Response

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THE EXPERIMENTAL study reported herein is concerned with two problems: 1. The basic degree of relation, or absence of relation, between individual differences in reaction time and in speed of movement; 2. The role of sensory stimuli that function to improve speed of action when administered to the subject during the slower half of his successive responses to a reaction signal.[1]

The Two Problems

Concerning the first problem, it may be mentioned that it is commonly believed that the *reaction* and *speed of movement* functions are highly correlated. However, a recent report (3) has presented evidence that there is no correlation between reaction time and speed in sprint running, with the suggestion that this finding may be in part a reflection of the fact that reaction time variance is small in absolute magnitude compared with the variance of sprint time. It would seem desirable to extend the investigation to other types of movement, with reaction time measured as a relatively pure function uncomplicated by movement and the variance and duration of reaction and movement times so ordered as to be of comparable magnitude.

The second problem represents an extension of recent research (2, 5) on the use of a mild electric shock as a motivator to increase speed of movement. Possible prejudice concerning the use of shock would be avoided and practical application of the results would be simplified if it were possible to use other sensory stimuli, as for example sound or light, to increase speed of movement. On the theoretical side, there is considerable interest in the influence of varying both *sense mode* and *intensity* of the motivating stimuli in the hope that this will help in formulating an explanation of why and how the facilitating influence operates.

Methodology

Two movements were studied:

1. *Ball Snatch.* The subject's fingers rest on a reaction key. At the flash of a white signal light, S moves his hand forward and upward 12 inches to grasp

[1] In order to avoid confusion, the term *reaction signal* will be used to denote the stimulus to which the subject reacts by making the motor movement being studied, whereas the *motivating stimulus* is applied during the course of the movement and is the experimental variable that incites to faster action.

a tennis ball suspended by a string. The switch that flashes the light simultaneously starts two electric chronoscopes. One of these, measuring *reaction time*, is stopped by the act of lifting the fingers from the reaction key. When the ball is touched, the supporting string actuates a switch that stops the *total time* chronoscope. *Movement time* is computed by subtracting reaction time from total time.

2. *Treadle Press.* S reacts to a light as in the first situation, but moves the hand forward $5\frac{1}{2}$ inches to press a treadle that is $\frac{3}{4}$ inch higher than the reaction key. (The ball is removed when the treadle is in use.)

Prior to the flash of the signal light, a lower intensity warning light has been turned on as a preparatory signal. The preparatory interval is varied between one and four seconds, in accord with a systematic chance-order sequence.

The starting signal switch also (when desired) turns on an adjustable electronic delay switch, set to operate at S's median total movement time. When it operates, it administers a mild electric shock, or flashes a reflector-backed light a few inches in front of one of S's eyes, or turns on a loud sound in earphones worn by S. Completion of the movement by pressing the treadle or snatching the ball disconnects the *motivating stimulus*. As S proceeds through the experiment, the delay switch is readjusted from time to time, to follow improvement in S's median score.

Apparatus Characteristics

A detailed description of the apparatus has already been published (2). New or undescribed characteristics that would influence the results are as follows:

Reaction key. This is a small plastic strip that supports the fingers of S when he is waiting for the signal, and stops the chronograph by opening the circuit when his fingers are lifted. It projects only $\frac{3}{16}$ inch above the baseboard, operates with $\frac{1}{32}$ inch of movement, and requires no particular effort to hold down since it is fully depressed by 50 grams. It is a double-contact affair—the first circuit operates the reaction chronoscope as explained above, while the second is in series with the warning light so that E can avoid pressing the starting switch if S makes a premature start.

Treadle and ball. A force of 90 grams and a downward movement of $\frac{1}{8}$ inch stops the total movement timer and simultaneously opens the circuit to terminate the motivating stimulus.

Chronoscopes. The reaction timer is calibrated in units of 0.01 seconds; the accuracy is 0.003 seconds. The total movement timer has the same calibration, although the S.E. is larger, namely 0.009 seconds. In the statistical analysis which follows, the average of five determinations are used, which has the effect of cutting the instrumental error in half. Since the S.D. of individual differences is larger than 0.014 in the fastest movement studied, the instrument accuracy can be considered adequate for the present purpose (4). This expectation is supported by the relatively high reliabilities obtained, as will be shown later.

Motivating stimuli. The electric shock device supplies 60-cycle current through electrodes on the forearm with a current density of about 20 milliamperes per

square inch. A series neon light gives visual indication to E when S received shock. The motivating light is used at two intensities, *dim* with 64 foot candles at the eye of S, and *bright* with 1,000 foot candles. The motivating sound is a 3,000 cycle relatively pure tone, transmitted by a low impedance line through the switches to secure silence when they are open. The impedance is stepped up at the head phones, yielding 140 volts across their terminals. The resulting loudness of the sound, for a duration of several seconds, is approximately 96 decibels. Soft rubber earpiece caps are used to minimize the discomfort of wearing the headphones.

While the above description of the stimuli is adequate for reproduction of the experimental conditions, it does not specify the intensity as perceived by S. The frequency distribution of the durations of the motivating stimuli can be visualized as the upper half of a more or less normal curve with midpoint at zero. Using the typical figure of 0.04 seconds as the S.D. of the individual responses (total time) of one S, some 20 per cent of the motivation stimuli would have a duration of 0.01 second or less, nineteen per cent would be 0.01 to 0.02 seconds long, 16 per cent would range from 0.02 to 0.03, 13 per cent from 0.03 to 0.04, 11 per cent from 0.04 to 0.05, and so on. In other words, most of the stimuli are of very short duration and hence will be perceived at only a fraction of their *continuous* magnitude.

For sound, the law controlling the decrease in loudness with shortened duration is fairly well established (1); the sensation level would drop from the original 96 db. to 79 db. for a duration of 0.05 second, to 75 db. for 0.02 second, to 72 db. for 0.01 second, and so on. Thus the sound that was uncomfortably loud with a duration of the order of a half-second drops to the loudness of conversational speech for the majority of the motivational stimuli, and must be hardly noticeable when they are very short. Temporal summation also occurs in the case of light (8, *p. 564*); no doubt it is also present with the electric shock stimuli.

Subjects

Ss were naive insofar as reaction time measurements are concerned. They were volunteers from men's university physical education classes in elementary gymnastics and tumbling, to the extent of 80 per cent. The other 20 per cent were "gym rats" contacted while engaging in recreational use of the facilities. With the exception of one experimental group of ten men of the latter type (which will be specifically designated) all groups were balanced in the 80–20 ratio, and also as to the hour of testing. The method of testing was the same as that used in previous experiments (2, 5).

Comparison of Reaction and Movement Times

Sixty Ss were given 50 trials on the ball snatch test without motivating stimuli. Another group of 43 was given 20 trials on the treadle press test under comparable conditions. The writer is indebted to Richard H. Fairclough for technical assistance in conducting these tests.

In each of the experiments, the last five trials have been averaged and correlated with the average of the immediately preceding five trials. These particular sets of trials were used for the analysis in preference to earlier trials in order to be well beyond the influence of any practice or adjustment phases. It should be noted that these trials did not mark the end of the testing, but merely the end of the standard training period that was to be followed by the use of various motivating stimuli as will be described later. The descriptive statistics are given in Table 1.

TABLE 1
Statistical Description of Reaction and Movement Times

Tests	Trials	Reaction time (Sec.)		Movement time (Sec.)	
		M	SD	M	SD
Ball Snatch Group (N = 60)	41–45	0.191	0.0256	0.119	0.0136
	46–50	0.193	0.0255	0.121	0.0151
Treadle Press Group (N = 43)	11–15	0.216	0.0262	0.088	0.0146
	16–20	0.216	0.0284	0.089	0.0147

It will be observed that average movement time and variability, compared with reaction time, is only about two-thirds as large for ball snatch movement time and two-fifths as large for the treadle press. Nevertheless, the different phases of total movement are at least of the same order of magnitude and differ only slightly in reliability, hence the departure from the hoped-for ideal situation does not in any way invalidate the correlational analysis. It is of interest that the *relative* variabilities of reaction and movement are not greatly different—the coefficient V ranges from 12.1 to 13.4 for reaction time, compared with V's of 11.4 and 12.5 for the ball snatch movement. The treadle press movement V's, 16.5 and 16.6, are definitely larger for no obvious reason. All these V's are much larger than the coefficient of relative variability for sprint running, $V = 4.1$ (3).

The correlational analysis reveals reliable individual differences in both reaction time and speed of movement. In the case of reaction time, the reliability coefficients ($r = 0.79$ for the ball snatch group and 0.84 for the treadle press group) are surprisingly high considering that they are based on the average of only five trials per S. The corresponding coefficients for movement time ($r = 0.73$ and 0.79) are slightly but not significantly lower, the t ratios for the differences being 0.77 and 0.80.

Individual differences in reaction time and in movement are quite independent, as the two intercorrelations for the ball snatch experiment are almost exactly zero ($r = -0.07$ and 0.003). In the treadle press experiment, the intercorrelations between the two functions are slightly higher ($r = 0.15$ and 0.10). However, they are still well within the limits of the sampling error of a true zero correlation, even when corrected for attenuation in both variables.

Comparison of Motivating Stimuli and Phases of Response

This section of the study was limited to investigating the ball snatch movement. Sixty Ss, arranged in six groups of ten men each, were tested. There was a training series of 50 trials, followed by an additional 35 trials. In the experimental groups, these additional trials were made with the motivating stimuli turned on and reported by S as perceived during the slowest 40 per cent of the responses. It was of course present, although unperceived, in approximately 10 per cent additional responses.

The six groups were treated experimentally as follows:

1. No motivating stimulus
2. Motivated by dim light
3. Motivated by bright light
4. Motivated by bright light plus shock
5. Motivated by sound
6. Motivated by sound (possibly atypical group)

Chronologically, Ss of the first four groups were intermingled systematically during the testing. Group 6 was tested next, during an inter-semester period when only "gym rats" were available, so it is listed last as a possible atypical group. While the influence of motivation was at least as great in this group as in group 5 (see Table 2), the mean scores were about 10 per cent slower in total time, hence were not well matched with the other groups or the controls. For this reason, the data of this group have not been used in the graphic presentation (Figure I). Group 5, tested last, was comparable to the first four groups except for lack of intermingling with the controls.

TABLE 2

Statistical Significance ("t" ratio) of Gains in Speed between Ball Snatch Test and Retest

Group	Motivation	Reaction Time	Movement Time	Total Time
1	Control	1.32	1.46	2.22
2	Dim Light	4.60	2.94	4.78
3	Bright light	11.44	2.80	8.79
4	Light plus shock	4.88	2.15	5.09
5	Sound	3.61	2.09	5.22
6	Sound (unmatched)	4.45	3.47	4.60
2–6	All types	11.15	6.07	12.15

Practice effects. Inspection of the curves obtained by plotting *reaction time* against amount of practice (Figure I) reveals no evidence of any appreciable learning during the initial practice period of 50 trials. When the motivation is introduced, there is little change in average score for first five trials, although the variability seems to be increased considerably. By the tenth motivated trial, the full effect, an improvement of about 7 per cent, has occurred. Thereafter, the average curve maintains a linear trend.

In contrast, the *movement time* phase shows a steady improvement of about six milliseconds per 50 trials throughout the practice period. This is substantially the same practice trend that appears in the total time, and agrees almost

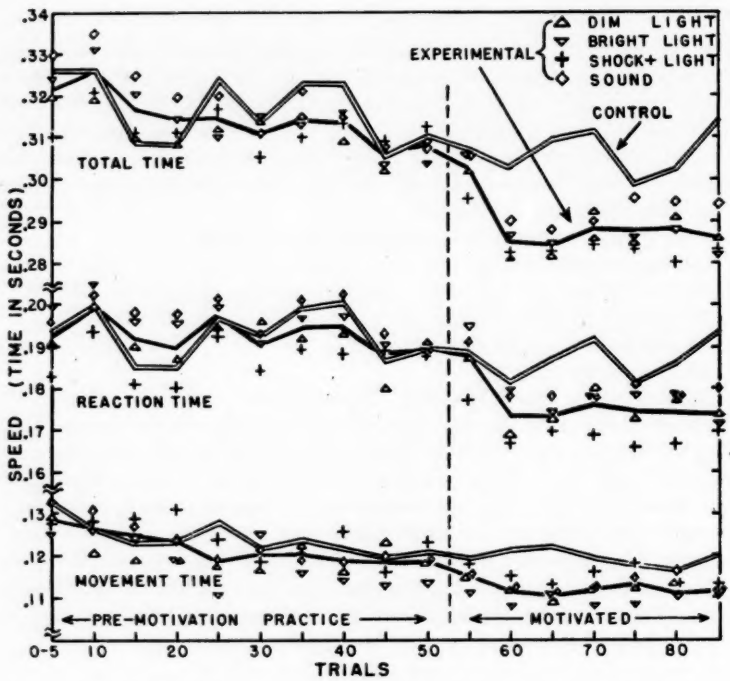

Fig. I. Practice curves showing the effect of the motivating stimuli on total time, reaction time, and speed of movement.

exactly with the improvement in total ball snatch time reported in the earlier study (2). The practice trend appears to continue during the 35 motivated trials, with indications of additional gain in speed due to the motivating stimuli.

Two types of statistical investigation of these data have been made—critical ratio and variance analysis. In both, the means of the last 30 motivation trials have been compared with the means of the last 40 pre-motivated trials for total time and reaction time, but only the last 25 pre-motivation trials have been used for movement time. The choice of these particular sections of the data for analysis was not entirely arbitrary—examination of the curves of Figure I will show that by this choice the practice effects and initial lag in the influence of motivation are minimized without biasing the results through including unrepresentative parts of the data or the initial phase of learning. A variance analysis of the pre-motivation scores establishes the fact that all groups were comparable at this point, within the limits of sampling error. The largest F ratio, 2.31 with one degree of freedom in the numerator when comparing the controls with all experimentals as to movement time, is definitely not statistically significant; all of the others are much smaller.

Influence of motivation on reaction vs. movement. The critical ratio analysis is given in Table 2. It can be seen that the control group does not change significantly between test and retest in either reaction or movement times, although there is a suggestion of a borderline practice effect in total time. All other groups show an unequivocal gain in reaction time and total time, but the results with movement time are not so clear-cut. The "matched" sound stimulus group does not change significantly, whereas the "unmatched" group does.

The two sound groups, when combined, show a significant change since t is 3.93. The other exception is the light-plus-shock group, with a t of only 2.15, which is of borderline significance. No doubt this represents another of those erratic variations that must be expected when testing small groups. A new sample would probably show a significant change, since the light alone is effective and other experiments have shown that electric shock by itself is also an effective motivator (2). Also, when the last 40 pre-incentive trials are used as in the reaction time comparison, both the light-shock and first sound group show significant gains (t = 2.86 and 2.96), although the validity of this comparison is perhaps questionable because of the tendency for a practice effect as may be seen in Figure I.

Although it is quite obvious from consideration of Table 2 that the motivated improvement is more consistent in reaction time than in movement time, and also true that the data of Figure I show a greater improvement for the former in time units (the t ratio between the gains being 4.96), the data at hand do *not* prove that movement time has been less influenced. It is not fair to compare the absolute time units of improvement, because movement time is quite arbitrary in magnitude, since it is determined by the nature of the motor task.

Such a comparison would be valid if both reaction and movement times were equal in average magnitude, but this desirable state of affairs was not achieved in the present experiment. It is necessary, therefore, to compare the *per cent* improvement in the two functions. When this is done, it turns out that the t ratio for the difference in improvement is only 0.90, which is certainly not significant. Considering all the data, it is necessary to conclude, first, that both reaction time and movement time are improved by the use of motivating stimuli, and secondly, that while the evidence suggests that the effect on the former is somewhat larger and more consistent, there is in fact no basis here for overthrowing the null hypothesis that the motivating effect has no differential influence on *reaction* as compared with *movement*.

Comparison of different motivating stimuli. In the preceding study (2), the hypothesis advanced in explanation of the increased speed of action due to administering a mild electric shock postulated that the improvement was due to the informational value of the motivating stimulus—during the slower half of the responses S was informed each time, by the duration of the shock, just how slow he had reacted. According to this hypothesis, the nature of the motivating stimulus, both as to kind and intensity, should make little or no difference provided that it was clearly perceived by S.

A plausible alternative hypothesis would be based on the Law of Effect (6, 8), holding that the motivating stimulus functions by punishment; under

this assumption, the stronger and more unpleasant the motivating stimulus, the greater its influence should be. Since the data at hand involve four different types or degrees of stimuli, they may be examined with respect to this theoretical problem. The appropriate statistical method would seem to be a variance analysis.

The results are shown in Table 3. No extensive discussion seems necessary—the F test shows quite clearly that variation in the type of motivating stimuli (i.e., *between experimentals*) has had no significant effect.

TABLE 3

Variance Analysis of Gains in Speed between Ball Snatch Test and Retest

Variance source	df	Reaction time		Movement time		Total time	
		MS	F	MS	F	MS	F
Between controls and experimentals	1	13.7	10.2	2.58	3.6	26.5	12.1
Between experimentals	4	0.20	0.15	0.38	0.53	0.30	0.14
Within	54	1.34	—	0.72	—	2.20	—

As a check, t ratios were calculated between the groups showing the largest differences, but no such comparison showed a t greater than 1.18. It is possible, of course, that the use of much larger experimental groups might have caused a significant differential effect to appear, but it is doubtful if such an effect can be very important in view of the small magnitude of the "between" F ratios and the t ratios.

Discussion

The results of the investigation as applied to a solution of the first problem appear to leave little room for question. Two independent experiments were performed. In each, reaction time and speed of movement were both measured. Each of these functions was found to exhibit significant individual differences, as evidenced by the reliability coefficients, which were not only significant but were of about the same magnitude in each experiment and for each function. Nevertheless, there was no correlation between reaction time and speed of movement—the two functions must therefore be considered as independent and unrelated.

This finding agrees with the results of another experimental investigation, recently reported, which found no correlation between reaction time and speed in sprint running, and certain other experiments cited therein which also have reported no correlation (3). It is exactly the opposite of the conclusions that were arrived at by other workers some 20 years ago, who found a very high correlation between reaction time and speed in sprinting (7). The writer can suggest no explanation for the aberrant results of the 1931 study.

Concerning the second problem, the practical aspects are coming into hand, although there is of course a need for considerable additional work as well as for confirmation. The results of motivation can be secured with either a light

or a sound stimulus; it is not necessary to use electric shock if that is considered to be undesirable. It does not seem to require very many trials to secure the effect; the present experiments indicate that application for ten trials is adequate, although it is possible that retention of the improvement may be better if a larger number of trials is used (5). The possibility of securing a greater effect by utilizing reinforcement on subsequent days is intriguing. While the intensity of the stimulus is apparently not very important, the optimum conditions for its application are not yet well defined.

One of the interesting problems that has not been touched concerns the proportion of reactions that should be motivated. So far, the aim has been to motivate half of the responses, which may be far from the optimal situation. Another important problem concerns complexity of response—so far, the investigation has been limited to rather simple motor tasks.

On the theoretical side, it should be pointed out that while the results of the current experiments have favored the "information" rather than the "punishment" hypothesis, there are other ways of attacking the problem and they should be employed before the results can be considered conclusive. There is also a third hypothesis that needs to be tested, namely that the motivation works through a general facilitating influence quite independent of possible informational aspects or increased punishment for over-long responses. Such a mechanism should be sensitive to changes in stimulus, hence its existence is not supported by the present experiments. There is also other evidence against it.

It may be calculated from the data of Table 1 that the mean total time was about 0.31 seconds; this signifies that for the average subject, the motivating stimulus was not turned on until *after* this amount of time delay. The mean reaction time was about 0.19 seconds with S.D. = 0.026; therefore, the reaction phase of the total response was necessarily completed in most cases before the motivating stimulus came into action. Yet the improvement was most consistent and perhaps greatest in the case of reaction time. This finding would seem to imply that the gain was probably *not* due to a direct facilitating function of the motivating stimulus on reaction time (since the reaction had already been completed).

It is unfortunate that the nature of the perceptive processes prevents a more clean-cut distinction between the variations of stimulus intensity. As explained in an earlier paragraph, perceived intensity of brief stimuli is a matter of summation, varying as the product of duration and stimulus magnitude. For this reason, when all stimuli are adjusted in duration so that they are perceived in the slower half of the responses, the difference between for example the dim and the bright light is much less than indicated by the illumination figures. Nevertheless, the bright light was introspectively of considerably greater brightness than the dim light. In the case of light-plus-shock there is a greater differential when compared with light only, since two distinct sense modes are involved in the perception.

In view of the extremely rapid improvement after the introduction of the motivating stimuli—mostly between the fifth and tenth motivated trials—it is

difficult to believe that the improvement could be due to learning in the ordinary use of the term. It may, of course, be ascribed to *latent learning* since the meaning of that term is somewhat elastic (6), but this will not prove very helpful in explaining the mechanism of the improvement. Any indication of *learning* appears chiefly in the movement time curves (Figure I) while the dramatic improvement appears in reaction time, where learning should be least, since there is practically nothing to be learned. It would seem more reasonable to argue that although learning is undoubtedly improved by motivation as has been established in many investigations, we are dealing here with an improvement in performance that is not necessarily related to the learning process.

Summary and Conclusions

Sixty college men were measured on a ball snatch co-ordination test, their responses being fractionated into reaction time and movement phases through the use of two chronoscopes. Another group of 43 men was similarly measured on a treadle press test. The uncorrected reliability coefficients for a five-trial sample of responses were $r = 0.79$ and 0.84 for reaction time and $r = 0.73$ and 0.79 for movement time. The reaction and movement functions are found to be independent and uncorrelated ($r = -0.07$ and 0.003 for the within-sample correlation in the first experiment and $r = 0.15$ and 0.10 in the second).

The 60 men were further studied by dividing them into groups of ten. One group was utilized as a control; the others were motivated by dim or bright light, electric shock plus bright light, or sound. The motivating stimuli were applied automatically, beginning at the median ball snatch response time for each individual, and persisting until the motor act was completed. This resulted in signalling to the subject just how slowly he moved, in the slower half of his responses.

All groups were significantly improved in reaction time and most of them in movement time, by whatever motivating stimulus they received. The effects of light-plus-shock were of questionable significance in speeding movement time, but analyzing the data as a whole failed to yield any evidence of a differential effect as between the various motivating stimuli. The results suggested that movement time was somewhat less influenced than reaction time by the motivation, but the statistical evidence did not clearly prove the point.

The results support the hypothesis that the improvement is due to the informative value of the motivating stimuli rather than to punishment as such, or to a direct facilitative function. Since the improvement occurred very rapidly, mostly within the space of five trials, and was most prominent in the case of reaction time rather than movement, it is unlikely that it involved learning in the ordinary use of the term.

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A Health Survey of Hunter College Freshmen

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THE MAIN objective of this study is to obtain a descriptive picture of the health status, attitudes, and practices of the Freshmen at Hunter College upon registration for the required course in personal hygiene. With this information, the total health instruction can be made more meaningful and pointed more effectively toward the needs of the student. From the results, clearer insight is gained into the student's estimate of her own health problems and attitudes. Thus we are able in classroom lectures, discussions, and conferences to shift emphasis to those areas where health problems are found to exist.

Source of Information

The statistical material was collected from the lower Freshman classes registered for the hygiene course over a period of four consecutive semesters (1948–50), during which time 1,033 students, constituting 41 lecture sections, were questioned. This is more than one-third of the total lower Freshman population of 3,016 students for the two-year period designated. The background of these college students embraces diverse nationalities and economic levels, as well as a myriad of interests. The sampling is representative of a cross-section of the entering Freshman class.

Technique and Presentation of Data

The inventory method was employed. Questionnaires were distributed to the student body and answered individually and anonymously. The results were then enumerated, tabulated, and the percentages determined. There are four main divisions of this study: personal appearance and body grooming; daily health habits; mental and emotional health; physical status of the subjects. The original, unabridged report may be obtained from the authors.

PERSONAL APPEARANCE AND BODY GROOMING

Introduction

One of the most effective tools for motivation of a hygiene course has always been a striving toward a neat and pleasing appearance. At the college level it is a very important and tangible goal. Student interest runs high on such topics as complexion care, attractive eyes, hair styling, and other aspects of personal appearance. Judgment by one's associates, as well as intensive commercial advertising, has played an important role in creating the impression that personal grooming is a "must" in determining the social success of the college student.

TABLE 1

Personal Appearance and Body Grooming

(Total Number of Students Questioned—1,033)

Aspects Investigated	% Yes	% No	± %[1]
1. SKIN			
Clear	69.31	29.04	1.65
Smooth Texture	23.04	74.64	2.32
Healthy color	86.06	12.20	1.74
Oily	38.63	59.14	2.23
2. HAIR			
Habitually clean	96.42	2.90	0.68
Usually neat	92.93	6.39	0.68
Shiny	85.77	12.49	1.74
Daily brushing	63.79	35.73	0.48
Appropriate style	98.84	0.58	0.58
3. EYES			
Normal vision	50.15	46.95	0.58
Visual errors as reported by 46.95%			
Nearsighted	63.51		
Farsighted	11.55		
Astigmatism	20.41		
Muscular co-ordination	1.23		
Other reasons	8.66		
Glasses worn when prescribed	85.98	8.87	5.15
Last examination			4.26
Within past year	80.93		
Within past 2 years	11.71		
Within past 3 years	1.94		
Longer	1.16		
Habitual frown	9.61	89.61	0.78
Eyes easily tired	25.26	73.87	0.87
Headaches	17.91	81.41	0.68
Alert expression	85.38	11.91	2.71
4. TEETH			
Number of daily brushings			1.16
1	18.97		
2	70.38		
3	8.23		
More	1.26		
Good occlusion	81.22	8.42	10.36
Dental visits			1.26
Every 6 months	46.66		
Every year	43.66		
Every 2 years	6.00		
Longer	2.42		
Need for attention	33.69	62.24	4.07
Number of permanent teeth extracted			2.23
None	68.25		
One	14.81		
Two	9.09		
Three	3.19		
Four	1.45		
Five	0.78		

TABLE 1—*Continued*

Aspects Investigated	% Yes	% No	± %[1]
Number of permanent teeth extracted (cont.)			
Seven	0.09		
Eight	0.09		
Extraction of 6th year molar	37.81		
Number of fillings			10.46
None	3.09		
One	1.07		
Two	2.03		
Three	4.84		
Four	10.74		
Five	9.61		
Six	11.62		
Seven	5.32		
Eight	10.55		
Nine	3.78		
Ten	5.23		
More	21.68		
5. MOUTH			
Happy expression	90.22	7.07	2.71
Mouth-breathing	10.26	86.06	3.68
6. HANDS			
Cleanliness	85.19	14.03	0.78
Smooth skin	85.77	13.55	0.68
Care of nails and cuticle	74.15	25.07	0.78
Nail biting	20.04	78.40	1.56
Split nails	26.62	71.93	1.45
7. FEET			
Toes straight	81.22	18.20	0.58
Ankles straight	90.13	7.06	2.81
Shoes worn without hose	31.27	67.95	0.78
Feet bathed daily	63.79	32.34	3.87
Fallen arches	9.79		
Corns	21.10		
Callouses	31.07		
Bunions	1.26		
Athlete's foot	6.39		
Foot examination & treatment			4.65
Never	77.64		
Rarely	15.68		
Regularly	2.03		
8. SHOES			
Adequate size	98.84	0.29	0.87
Moderate heel	90.22	6.49	3.29
Firm support	76.28	19.65	4.07
Proper vamp	86.06	5.03	8.91
Straight inner edge	77.86	9.48	12.66
Flexible leather	92.16	3.00	4.84
Appropriate design	97.29	1.84	0.87
Change after school	57.41	40.27	2.32
9. POSTURE			5.13
Excellent	12.20		

TABLE 1—*Concluded*

Aspects Investigated	% Yes	% No	± %[1]
9. POSTURE (*cont.*)			
Good	66.71		
Poor	14.70		
Very poor	1.26		
10. CLOTHING			
Clean and pressed	91.97	7.64	0.39
Good state of repair	93.80	6.01	0.19
Suitability for school	97.48	2.43	0.09
Straight stocking seams	83.54	14.14	2.32
11. WEIGHT[2]			
Average	61.00		
Overweight			
1–5 lb.	12.00		
5–10 lb.	7.60		
10–15 lb.	5.50		
15–20 lb.	1.40		
20–25 lb.	3.20		
25–30 lb.	0.70		
30 and more	2.00		
Underweight			
1–5 lb.	2.30		
5–10 lb.	2.70		
10–15 lb.	1.40		
15–20 lb.	0.20		
Constant weight during the past year	61.28	37.17	1.65

[1] The percentages in this column represent the answers that were omitted or ambiguous.

[2] This weight table is based on McCall's study of 1,949 college women over a five-year period. It allows for considerable flexibility by stating a wide weight range for the respective heights and ages. Because of these wide variations, body structure has been taken into account. The mean weights are listed with ±1 Probable Error between the limits of which were found to be included 50% of her cases. McCall, Margaret. Age-Height-Weight Table for College Women, *The Research Quarterly of the American Physical Education Association* 8, 101–102, March 1937.

ANALYSIS OF TABLE 1

Skin. The complexion of the student is essentially clear, of good color, and smooth. The main shortcoming is skin oiliness, as reported by almost 40% of the group questioned. These results are very similar to those of other surveys (3, 8, 9, 10, 11).

Hair. Investigation of hair condition indicates that little instruction or guidance is needed here. Since, however, more than one third of the group does not practice daily brushing of the hair, this desirable habit should be justifiably emphasized.

Eyes. When one considers the vast amount of near work required of students, it is not surprising to find that only one half of the freshmen students questioned at Hunter have normal vision. One fourth of the students reported that their eyes tire easily, and almost one fifth have frequent headaches, although only one tenth of the group frown habitually. Of the 485 whose vision was reported as not normal, 86% wear glasses and only 8.8% fail to do so. The eye disorder occurring most frequently is nearsightedness (one third of those wearing corrective lenses suffer from this condition), while one tenth of the students have astigmatism, and 5.5% are farsighted.

The students have had their eyes examined recently, as evidenced by more than 80% reporting that they have had an ocular examination within the past two years. Only 1.16% have not had an ocular examination within the past three years. These results are not very different from those reported in similar studies (2, 5, 9, 11).

Teeth. Dental caries still remain a baffling health problem. Almost 90 per cent reported brushing their teeth either twice a day (70.38%) or once a day (18.97%). Ninety per cent visit the dentist every six months or yearly; nevertheless, more than one third of the group have teeth which need attention at present. No extraction of permanent teeth is reported by 68%. Of those who have had extractions, 37.18% have lost the sixth year molar. The incidence of fillings is high. More than one fifth of the group have more than ten fillings. The one bright spot in the dental findings is good occlusion (81%). Mouth breathing occurs in only one tenth of the group. The results of the dental survey agree with those in other universities (2, 8, 9, 11).

Hands. The condition of the hands of the students is generally satisfactory. Only 13 to 14 per cent of the group have rough hands or hands not usually clean. Twenty per cent reported that they bite their nails, and one quarter of the group require care of their cuticles.

Feet and Shoes. The answers on foot condition are very satisfactory, since 80 to 90 per cent report that they walk correctly and maintain correct foot position. It is enlightening to discover that almost one third of the students occasionally wear their shoes without hosiery, and almost as many (32%) do not bathe their feet every day. Some additional emphasis in hygienic instruction is hereby indicated. As for common foot defects, almost two thirds of the group reported in the affirmative: for callouses, 31%; for corns, 21%; fallen arches, 9.8%. Only 2% of those questioned visit the podiatrist or chiropodist regularly (11).

Judged by the response to the questions on shoes, the areas where the need for improvement requires greater educational emphasis are: the need for firm support in shoes and the desirable practice of changing shoes worn during the day. In general, the results of the questionnaire pertaining to shoes are satisfactory.

Posture. According to the student ratings, 66 per cent judge their posture as good, 12.2 per cent as excellent, 16 per cent reporting their posture as poor. Nevertheless, there is substantial interest in posture improvement by the student body. In the last two years, 2,919 freshmen at Hunter College were registered for physical education courses, and of this group 588 students (20.14%) voluntarily elected the course in Body Mechanics (8, 11).

Clothing. The status of clothing for the group is on a very high plane, as found by studying the statistical results on suitability, cleanliness, neatness, and state of repair. Ninety-seven per cent wear clothing suitable for school. This comes as no great surprise, when one considers the interests and age of these young women, the influence of their associates, as well as the strong impact produced by advertising in this field.

Weight. Body weight data reveal that over three fifths of the group studied are within the "average" range of weight for college women in this age group. The greatest variation in weight shows that approximately one third (32.4%) are overweight and, of these, 19.6 per cent reported overweight within ten pounds. Only 6 per cent are underweight. A little over three fifths of the group reported that their weight has remained constant during the last year.

Conclusion and Recommendations.

The results of the investigation of personal appearance and body grooming indicate the major fields of weakness to be ocular hygiene, dental care, and foot hygiene. Suitable conditions of eye-work, such as resting the eyes, adequate lighting, proper posture while reading, and direct care of the eyes need to be emphasized. Greater stress is required on the importance of regular dental care as well as the other possible ways of preventing dental caries which still remain a baffling problem to the experts. A study of the criteria for selecting suitable shoes and a renewed emphasis on the proper habits of foot hygiene should yield fruitful results.

DAILY HEALTH PRACTICES

The purpose of this section of the study is to obtain statistical data on the daily health practices of the Hunter freshmen as they relate to their nutrition,

exercise, recreation, studies, and a variety of miscellaneous factors in order to establish threshold values among the first-year college students.

In the nutritional area essentially qualitative information was sought on specific daily dietary inclusions that furnish the nutritive essentials. The results follow in Table 2.

TABLE 2

Nutritional Data

(Total Number of Students Questioned: 1,033)

	% Yes	% No
FOODS CONSUMED DAILY		
Milk (at least one and one half pints or three glasses)	73.86	26.14
Dairy products (butter, cream, or cheese)	94.29	5.71
Eggs (three or more per week)	78.41	21.59
Meat or Fish	97.97	2.03
Whole-grain cereal food (eaten as cereal or dark bread)	46.85	53.15
Green vegetables	91.09	8.91
Root vegetables (potatoes, carrots)	92.26	7.74
A raw vegetable (lettuce, salad greens, raw cabbage, celery)	91.29	8.71
Legumes (peas, beans, lentils at least twice weekly)	82.48	17.52
Citrus fruits	93.51	6.49
One additional fruit	78.03	21.97

	Percentage
BEVERAGE CONSUMPTION	
Water	
1 to 2 glasses	49.27
3 to 5 glasses	38.92
6 to 8 glasses	8.81
more than 8 glasses	0.68
+ or −%*	2.32

	Number of Servings			
	0	1-2	3-4	More
Additional Beverages				
Tea	4.94%	32.53%	2.52%	0.09%
Coffee		41.72%	9.09%	2.61%
Cocoa		17.81%	0.78%	0.39%
Soft drinks		23.52%	2.42%	2.52%

	Percentage
Alcoholic Beverages	
Do not drink	56.05
Do drink occasionally	43.27
±*	0.68

* The percentages in this column represent the answers that were omitted or ambiguous.

Any attempt to improve the daily health practices of our students must necessarily start with the basic knowledge of their current habits in the various phases of daily healthful living. To this we can add or point up established scientific facts concerning health and develop a more personal interest and mature attitude on the part of the student regarding a growing responsibility for her own health. As an end point it is to be hoped that the students will establish and apply satisfactory health habits to serve throughout a lifetime.

ANALYSIS OF TABLE 2

A study of the nutritional data reveals the following:

1. *Meat or fish* is chosen daily by the greatest number of students (97.97%), representing 1,012 girls.
2. *Dairy products* (butter, cream, or cheese) come next in order of popularity with 94.29%. This represents 974 students.
3. *Vegetables* of various kinds (green, those in the root group, and raw varieties such as salad greens) are all above the 90% level. See Table 2. The legumes are eaten at least twice weekly by 82% of those questioned.
4. *Citrus fruits* are consumed daily by 93.5%, but the desirable inclusion of at least one additional fruit shows a decline to 78.03%.
5. *Eggs* (3 or more per week) are eaten by fewer students: 78.41%.
6. *Milk*, the most protective food in the diet, is taken in adequate amounts by 73.86% of the group.
7. *Whole grain cereals* lag at the end with a daily consumption reported by 46.85%.
8. A water intake in recommended amounts of two quarts or more is taken by only 9.49%. If, however, we examine the additional beverages consumed daily in significant amounts, 41.7% reporting 1 to 2 cups of coffee and 32.5% drinking a comparable amount of tea, the daily consumption of total liquid is appreciably greater.

An attempt was made to rate the food selection of the Hunter students on a score card issued by the Department of Agriculture (23). We found the over-all average to be 82.8%, which is a "fair to good" nutritional score.[1]

Recommendations

In the light of our findings revealed in the nutritional data, renewed effort should be made by the teacher to:

1. Increase the whole-grain cereal foods of the student dietaries by additional emphasis on the inclusion of such foods as whole-grain cereals including the ready-to-eat variety; the dark breads, or enriched breads; and the many dishes which may be prepared from these sources. They so readily lend themselves to the breakfast meal that the desirable practice of eating a "better breakfast for top efficiency" could be profitably correlated here.
2. Effectively present the value of inclusion of an adequate amount of milk as the most highly protective food of the entire dietary, since 26.14% reported daily consumption of less than the recommended pint and a half. The teen-age student group is still growing and hence requires an added safety factor over the minimal amount.
3. Stress the value of an adequate water intake each day and develop better water-intake habits.

[1] To compare the findings at Hunter College with similar studies in other schools, see 16, 18, 19 in References).

4. Urge the inclusion of additional eggs in the daily diet as an excellent source of iron. Of the Hunter group, 21.59% report eating less than the recommended minimum of three eggs per week. This dietary supplement might be instrumental in reducing the incidence of anemia, which was found to be quite prevalent. (See Table 4).

5. Remind students of the value of including additional fruit other than those of the citrus group.

TABLE 3

Daily Health Practices

(Total Number of Students Questioned: 1,033)

Practices Investigated	% Yes	% No	±%[1]
Daily bathing	58.76	41.15	0.09
At least 3 warm baths weekly	71.64	26.23	2.13
Regular bowel movement daily	86.06	13.65	0.29
Laxatives taken frequently	4.94	94.87	0.19
Regularity of meals	78.61	20.91	0.48
Non-school activities (at least 1 day plus 2 add. afternoons or evenings)	78.12	21.20	0.68
A planned time schedule for studies	48.11	50.53	1.36
Completion of assignments on time	72.41	26.43	1.16
Medicine taken only upon advice of physician (moderate use of aspirin excluded)	92.45	7.16	0.39
Use of stimulating drugs	1.74	97.20	1.06
Frequent use of sleeping pills	0.97	97.77	1.26
Fatigued most of the time	22.46	76.76	0.78
Refreshed and rested upon arising	49.27	49.17	1.56
Sleep			
8 hours	47.63		
7 hours	25.46		
6 hours	18.49		1.93
5 hours	6.29		
4 hours	0.19		
Smoking	37.46[2]	61.67	0.87

Number of Students	Number of Cigarettes Smoked Daily
244	1 to 5
78	6 to 10
28	11 to 15
26	16 to 20
5	more
6	±% (no answer)
387	

Weekly Exercise	None	1 hr.	2 hrs.	3 hrs.	4 hrs.	More	±%[3]
Exercise (very active)	10.65%	8.62%	40.95%	20.22%	9.09%	9.29%	1.16%
How much of this excercise is out of doors?	58.08%	18.29%	9.39%	4.65%	1.84%	3.48%	4.26%

[1] The percentages in this column represent the answers that were omitted or ambiguous.

[2] 37.46% equals 387 students.

[3] The percentages in this column represent the answers that were omitted or ambiguous.

At the same time we must attempt to develop in each student a facility for careful and thorough critical analysis of her own dietary, based upon scientific fact. We should also motivate every girl to choose her personal diet so that it will contain all the nutritive essentials in correct proportion compatible with the optimal nutritional standard and also distribute her food budget in the most satisfactory manner (20).

ANALYSIS OF TABLE 3

Sleep. Fewer than half (47.63%) of the total number of students questioned stated they sleep eight hours or more nightly, while 25.46% of the students reported sleeping seven hours (13, 21). We have made no attempt to seek the causative factors in this inventory, except to state that in the Freshman group the change in curriculum experienced during the first year in college is generally one of increased content compared with the last year in high school. Hence, there is the pressure of assignments, plus many problems of self-adjustment to college life. Work habits are frequently poorly developed in terms of planned study time; 50.53% of the Hunter group reported that they had no planned time schedule for studies. These factors may account in part for many girls reporting too little sleep.

It is interesting to note that the size of the group who reported feeling refreshed and rested upon arising (49%) compares closely to the percentage of 48% who stated they received eight hours sleep or more nightly. There are 22.46% who reported they were fatigued most of the time and 24.97% state they receive between four and six hours sleep. The frequent use of sleeping pills is insignificant as is the use of stimulating drugs.

Daily Bathing. Results obtained here show that 71.6% of the total number of students questioned stated that they take at least three warm baths weekly, and daily bathing is reported by 58.7% of the entire group of 1,033 girls. It would appear that definite improvement of this desirable practice should be made.

Exercise. A lack of active physical exercise throughout the week is evident, with the greatest number of students (423, representing 40.95%) reporting only two hours of exercise weekly. In many cases this represents the time allotted to the required physical education course. Over one half of the entire group (58%) states that none of their exercise is out of doors. Because physical fitness is a recognized aid to general body health and most certainly in developing an ability to withstand fatigue, a renewed emphasis on the desirability of some daily exercise, outdoors if possible and within the framework of personal adaptation, is urged. Among the multiplicity of effects of such a practice might readily be the eradication of constipation, reported by 13.65% and the need for the frequent taking of laxatives as indicated by 5% of the group.

Smoking. The incidence of smoking among the Hunter Freshmen questioned is 37.46%, which is equivalent to 387 students. The greatest number of these (244, representing 61%) state that they smoke not more than five cigarettes daily (22). That excessive smoking may involve serious hazards to health is generally conceded (14, 15).

Recommendations

1. Some form of regular daily exercise, preferably out of doors, is strongly recommended.
2. Further study is needed of the prevalent factors within the group which may account for too little sleep, before attempts are made to resolve them.
3. Additional emphasis on the advantages of daily bathing is indicated.
4. The physiological effect of tobacco on circulatory behavior should be made quite clear to the students when the subject is dealt with in the classroom, since all of these factors raise a question as to the advisability of smoking.

MENTAL AND EMOTIONAL HEALTH—SUBJECTIVE REACTIONS

In this section of the study, recognition is granted to the permeation of mental and emotional health into many aspects of the physical health of the students. Hence, some estimate of the former must necessarily be included in a general inventory of health status.

That the students do have many problems far beyond the learning of facts has long been recognized. Ruggles (35) reveals the nature of student problems in relation to proper scholastic adjustment in college to be:

1. Improper training in concentration and attention.
2. Physical problems.
3. Environmental and psychological difficulties.

The mental and emotional health of the students should be a matter of concern to their own respective communities, since many of our students today will lead in the national thinking and support the health laws of the future. If a student leaves college with unhealthy personality traits and habits, his entire outlook will be out of focus and not conducive to worth-while citizenship. Interest in personal mental health is shown by an increased number of students.[2]

ANALYSIS OF TABLES 4 AND 5

A critical scrutiny of the foregoing results reveals our Hunter Freshmen as essentially well-integrated in the five areas of mental health included in the inventory. The highest results were obtained in one phase of their social adjustment, exemplified by friendliness toward others (97.19%) and a readiness to co-operate (96.23%).

These findings compare closely with those indicative of an important ethical adjustment, i.e., a willingness to listen to both sides of an issue (97.19%). Hunter students maintain a cheerfulness of disposition (94.87%) and an ability to enjoy themselves independently (92.74%). These habits are well worth while; yet others stand clearly revealed as deficiencies and limitations in personality which should be more effectively directed. Examination of these weaknesses tabulated below and allocated into the four major areas (see Table 4) reveals evidence of very human faults, recognizable in any age group.

The most conspicuous weakness in the emotional health area is the frankly admitted tendency to worry and brood (51.11% reporting in the affirmative).[3] In the area of intellectual adjustment, the Hunter survey revealed that a high percentage of girls (56.23%) waste time and energy thinking about tasks which promise to be difficult. This percentage checks closely with the "worriers." Approximately one fourth of the group studied (25.75%) state that they do not readily admit their personal mistakes, which may be included in the 33.49% who make excuses for themselves. These figures serve to point up the existence of conspicuous personality weaknesses which should be controlled in order to encourage healthy personality growth.

Recommendations for the Improvement of Mental Health

1. More intensive classroom instruction in the principles of mental health combined with an active collegiate program to implement these principles (32).

Since mental health is closely related to environmental influences, it can be achieved in part by building up within the individual a higher immunity to mental ill health by an improvement and development of personality through contact with a variety of social and academic experiences. The college should

[2] For comparative studies in other colleges, see 28, 29, 33 in the References.

[3] For comparative studies in other colleges, see 34 and 36.

TABLE 4

Mental and Emotional Health-Subjective Reactions (21, 38)

(To Furnish Evidence of a Well-Integrated Person)

	% Yes	% No	± %*
1. EVIDENCE OF EMOTIONAL HEALTH STATUS			
Cheerful	94.87	4.84	0.29
Self-confident	79.19	19.94	0.87
Control of temper	82.96	15.88	1.16
Control of emotional responses and feelings	89.36	9.48	1.16
Faces reality courageously	81.80	15.88	2.32
Seeks sympathy	29.33	68.83	1.84
Accepts disappointments without bitterness	84.41	14.03	1.56
Makes excuses for self	33.49	64.77	1.74
Faith in one's self	84.22	12.97	2.81
Worries or broods	51.11	46.66	2.23
Feelings are easily hurt	46.18	51.79	2.03
Frequently irritable	19.06	80.16	0.78
Frequently sulks	12.49	87.54	0.97
Magnifies difficulties	28.17	69.80	2.03
2. INTELLECTUAL ADJUSTMENTS			
Ability to concentrate on a given task	81.32	16.65	2.03
Ability to enjoy one's self when alone	92.74	6.78	0.48
Self-reliance in making decisions	89.06	9.78	1.16
Special interests or hobbies	83.83	15.98	0.19
Daily recreation	75.99	23.72	0.29
Satisfaction with one's life plan	78.03	19.36	2.61
Ability to make the most of what one has	85.97	12.97	1.06
Wasting of time and energy thinking about tasks that promise to be difficult	56.23	42.21	1.56
General enjoyment of the daily school routine	79.97	19.06	0.97
3. SOCIAL ADJUSTMENTS			
Friendly toward others	97.19	2.52	.03
Self attempts to be interesting to others	90.03	6.19	3.78
Faith in others	89.46	13.54	3.00
Evidence of co-operation with others	96.23	3.29	0.48
4. ETHICAL ADJUSTMENTS			
Ready admission of personal mistakes	71.25	25.75	3.00
Willingness to hear both sides of an issue	97.19	2.03	0.78
5. ENJOYMENT OF BEAUTY IN ART, LITERATURE, AND MUSIC	96.91	2.61	0.48

* The percentages in this column represent the answers that were omitted or ambiguous.

provide many stimulating opportunities for personality development in terms of social contacts and programs, religious opportunities, curriculum offerings, improved methods of academic testing, development of cultural interests, and a more personalized counseling service. Hunter College, as an institution of higher learning concerned with teacher training education, has an extra measure of responsibility for the mental health of its students. These young people should be trained to utilize the advances of mental hygiene in their future contacts with their pupils (32).

TABLE 5
Personality Weaknesses of Hunter College Freshmen

Emotional Health Status	*Percentage affirmative*	Intellectual Adjustments	*Percentage affirmative*	Social Adjustments	*Percentage affirmative*	Ethical Adjustments	*Percentage affirmative*
Worries and broods	51.11	Wastes time thinking about difficult task	56.23	Lacks faith in others	13.54	Does not readily admit personal mistakes	25.75
Feelings easily hurt	46.18	No daily recreation	23.72				
Makes excuses	33.49	Dissatisfied with life plan	19.36				
Seeks sympathy	29.33	Does not enjoy school	19.06				
Magnifies difficulties	28.17	Does not concentrate on a given task	16.65				
Lacks self-confidence	19.94	No special interests or hobbies	15.98				
Frequently irritable	19.06	Does not make the most of what she has	12.97				
Lacks control over temper	15.88	Lacks self-reliance in making decisions	9.78				
Cannot face reality courageously	15.88						
Acceptance of disappointments with bitterness	14.03						
Lacks faith in self	12.97						
Frequently sulks	12.49						
Lacks control over feelings and emotional responses	9.48						

2. Adequate opportunity for students to obtain skilled advice on their personal problems.

A sympathetic understanding of this age group and a knowledge of the motives of human behavior are essential. This phase of the program might be in the form of a mental-hygiene clinic service. The classroom teacher, who comes in direct contact with the students over a period of time and has frequent opportunities for informal counseling, should participate in this program as the key figure for student reference. The clinical psychologist, a college psychiatrist, and other qualified personnel who have been professionally trained in the problems of mental health and illness would constitute an effective advisory board.

3. Delivery of regular addresses or discussions on mental health to the college staff and parent groups by authoritative personnel.

The effect on the faculty members should be one of stimulation and a renewed awareness of their responsibility for the total development of the student, which includes personality growth as well as academic progress (27, 28). An aware and alert teaching staff, willing to recognize student problems and the facilities of the college for solving them, can co-operate immeasurably in their solution. The importance of the parents' role in molding the personality pattern during early childhood should receive proper emphasis.

4. Acquisition of literature by the college—books, periodicals, compiled bibliographies—that will illuminate the various phases of mental hygiene.

Such literature should be made easily available to all students to serve as required reading at sometime during their college life. Opportunity for discussion under the guidance of trained personnel should be continued.

PHYSICAL STATUS

In the fourth division of the survey, pertinent questions were asked on the physical status of the Hunter College Freshmen. The students indicated the area of the body involved, stated the nature of the existing defects and answered supplementary questions on colds, anemia, and sinus conditions. The types of immunization inoculations received by members of the group were also recorded.

Similar information would appear in the findings obtained from complete medical examinations of the students conducted by their personal physicians and, in part, by staff doctors of the college. These records serve as the basis for recommendations of necessary remedial measures as well as the subsequent follow-up of cases.

ANALYSIS OF TABLE 6

Table 6 on the physical status of the Hunter College student reveals that close to one half (42%) reported the absence of any defects (8). Of the specific types of defects listed in the Hunter health survey, the eye disorders far exceed all others (43.27%). The other predominant findings show that 12.88% of the group are anemic, and approximately one tenth (10.94%) suffer from chronic sore throat. A small proportion of the cases (3% to 4%) reported ear defects, metabolic difficulties, or dysmenorrhea respectively. The remainder of the defects revealed through the check list were sparsely scattered throughout the body areas and insignificant in number (11).

TABLE 6

Analysis of Physical Status

(Total Number of Students Questioned: 1,033)

	Number of Students	Percentage of Total Group
DEFECTS: (tabulated by body area involved)		
No defects	435	42.11
Eyes	447	43.27
Cardio-vascular system		
Heart	29	2.81
Blood (anemia)	133	12.88
Respiratory tract		
Chronic sinusitis	68	6.58
Throat (frequent pharyngitis)	113	10.94
Ears	41	3.97
Faulty metabolism	35	3.39
Reproductive system	28	2.71
Digestive system		
Stomach	7	0.68
Intestines	5	0.48
Liver and Gall bladder	2	0.19
Excretory system		
Kidneys and bladder	3	0.29
Orthopedic defects		
Spine	2	0.19
Feet	4	0.39
Allergy	4	0.39
Muscular system (rheumatism)	3	0.29
Skin	2	0.19
INCIDENCE OF COLDS YEARLY		
None	51	4.94
1–2	686	66.42
3–5	219	21.19
6–8	34	3.29
More	18	1.74
*±%	25	2.42

IMMUNIZATION

Disease	% Yes	% No	No Answer
Smallpox	95.16	0.48	4.36
Diptheria	87.61	6.58	5.81
Whooping cough	39.79	44.14	16.07
Tetanus	19.84	55.96	24.20
Typhoid fever	1.45	98.55	—

* The percentages in this column represent the answers that were omitted or ambiguous.

As already stated at the beginning of our study, the Hunter findings reveal a great need for dental care and improvement (33.69%). Posture, however, does not present a major health problem among the Hunter freshmen. Nor does dysmenorrhea in the Hunter College sampling seem to be as widespread (2.71%) as in comparable groups (6, 8).

The incidence of colds in the Hunter students was very high. The majority (66.42%) reported one to two colds per year. About one fifth of the group have three to five colds per year, 3 per cent suffer from six to eight and only approximately 5 per cent of the total questioned escape colds (8, 10).

These data on physical status indicate a high level of the over-all standard of physical health of the Hunter College Freshmen with the exception of their visual defects, respiratory ailments, and anemia. Further instructional emphasis, with effective motivation as well as close co-operation with the medical office, is hereby indicated.

The chart on immunization reveals what would be expected from a group of college students educated in the public schools of a large city. Ninety-five per cent reported smallpox vaccination, although it is realized that there is a slight discrepancy here, since smallpox vaccination is a requirement for entrance to the public school. Possibly this indicates the need for further elucidation of smallpox vaccination objectives and procedures.

The figure for diphtheria vaccination was almost as high (87.61%), in no small part attributable to the intensive campaign and the facilities offered by the Health Department of New York City. When whooping cough immunization was considered, one half of the students questioned had been inoculated. This is surprisingly low, although it is the opinion of the writers that many of the students either did not accurately recall this vaccination or confused it with other procedures.

Almost one fifth of the group studied had been inoculated against tetanus. This may be attributed partially to the common practice of Hunter students attending summer camps which require this vaccination for admission. Furthermore, this vaccination is now receiving greater emphasis by the public health authorities in urban localities as well as in rural areas. Tetanus inoculations will probably show a definite upward trend in the light of present-day recommendation for the combined diphtheria, tetanus, and whooping cough immunization during early childhood.

Recommendations

1. Attempt to reduce the incidence of anemia through dietary recommendations as well as additional time spent in the open air.
2. Increase emphasis on prophylaxis for colds, with stress on prompt and rigid control to avoid further spread.
3. Aim to reduce the incidence of eyestrain by a thorough understanding and practice of good habits of ocular hygiene, with renewed emphasis on adequate illumination, proper direction, correct posture while reading, frequent rest intervals, and periodic eye examinations by an ophthalmologist.
4. Encourage close co-operation among the several divisions of the college which are directly concerned with the health status and needs of the students: Medical Office, Office of the Dean of Students, Academic Dean, Department of Physical Education, Department of Physiology, Health, and Hygiene, and the Bureau of Educational and Vocational Guidance.
5. Revitalize the subject matter generally by introducing significant statistics showing the prevalence or absence of health habits and practices, the frequency of existing defects, and directed observational studies carried out by the students on themselves, their families, and friends to personalize the course content.

GENERAL SUMMARY

In summary, this research study has provided a description of the health status, attitudes, and practices of Hunter College Freshmen. Careful consideration of these findings indicate clearly those health areas in need of improvement and modification of emphasis.

Classified Results

When the results are classified according to the four areas of this study, the salient conclusions are as follows:

Personal Appearance: The results, although generally satisfactory in this area, reveal three major fields of weakness: ocular hygiene, dental care, and foot hygiene which require renewed emphasis for health.

Daily Health Practices: The dietary findings reveal a "fair to good" nutritional score. A higher status may be obtained by supplementing the daily diet with whole grain cereals and more milk. A reiteration of the values of an adequate water intake, as well as additional fruit and eggs, is indicated by the results. The data reveal the need for increasing both the amount of regular daily exercise and the hours allotted to sleep.

Mental and Emotional Health: Although the Hunter freshmen are essentially well-integrated in their personality reactions, nevertheless results in Table 5 reveal clearly certain deficiencies and limitations which require more effective direction. Among these, the tendency to worry, to be oversensitive, to rationalize, to waste time and energy are dominant.

Physical Status: The level of physical status in the group questioned is generally high, with the exception of widespread ocular disorders, some anemia, and chronic pharyngitis.

Storey's Findings

Before suggesting recommendations for improvement of the hygiene program at Hunter, it would be worthwhile to review very briefly some of the main findings of Storey (12) who conducted a detailed health survey of college hygiene procedures all over the nation. According to Storey, there should be four kinds of programs organized for the health benefit of the students:

1. Informational hygiene.
2. Student health services, including health examination.
3. Applied hygiene, covering physical training, sports.
4. Administrative hygiene, the institutional offices, regulations and arrangements safeguarding the environmental hygiene of the student, the hygiene of the student's extra-curricular program, the hygiene of schedules and curricula.

The Program at Hunter

At Hunter we attempt to cover all the fields of health, either through the required personal hygiene instruction or supplementary public health courses. Since we consider mental hygiene an integral part of the complete health picture, it has a definite and important place in the hygiene syllabus. Storey recommended that hygiene courses be scheduled for two or three periods each week over a period of four or more semesters.

We have at Hunter, two hours per week for one term, classes, made up of lower or upper Freshmen usually, devoted to personal hygiene exclusively. Separate optional courses in public health, family hygiene, and industrial

hygiene are also offered. There is common agreement among the instructors of the personal hygiene course that the course is too crowded and there is an inadequate amount of time available for student counseling. Therefore, we have been endeavoring to have one extra hour added, primarily for health counseling and supplementary hygiene films, but the present outlook for this desirable curriculum revision is very dim. Storey also recommended that hygiene sections be limited to 20 students each. While we endorse this size class as a maximum number for effective teaching, our hygiene classes range from 22 to 26 students, with a median of 24.

At Hunter we do not use the straight lecture method, but rather a modified lecture and class-discussion technique, as a means of arousing interest, thought, and personal application. Individual student conferences are arranged by the instructors either formally or informally. No program credit is set aside for this purpose. Visual aids in the form of models, charts, drawing, and motion pictures play an important role in classroom presentation.

We are vitally concerned with the application of health principles explained in the classroom to the students' everyday routine living habits and therefore have frequent checkups (diet lists, footprints) to determine the extent of application of the factual information. Since the crucial test of all personal hygiene instruction is the improvement of health through the formation of good health habits and attitudes based on sound information, we aim to emphasize those areas which require further explanation or development of proper attitude (8).

General Recommendations

1. Add one hour weekly to the existing schedule of hours allotted to the required college hygiene, making the course three hours weekly, the third hour to be allocated to individual conferences, films, and practical problems.

2. Every effort should be made to limit the number of students to a maximum of twenty per class to ensure a more personalized contact.

3. Findings reveal a need for further teaching emphasis in each of the four general areas explored in this survey.

Regrouping of the topics in the course around real life situations—such as making a good impression, control of the popular vices, planning a reasonable work schedule, realization of one's potentialities—supplemented by class discussions revolving about these everyday experiences, would provide an intensification of interest and offer a practical method of presentation to motivate the course. The study has brought more clearly into focus the over-all health status of the Hunter Freshmen and, together with the recommendations suggested, may provide a starting point for a greater enrichment, more fruitful channeling of efforts, and further expansion for a more effective college-hygiene program.

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A Comparison of the Reliabilities of Methods of Scoring Tests of Physical Ability

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There seems to be no general agreement with regard to the number of trials to use in scoring physical education tests, such as the standing broad jump, the jump and reach, the dash, and the soft-ball throw for distance. Likewise there is no agreement as to which of the trials or combination of trials yields the most reliable measure of the individual's ability on the test. Using the best "N" number of trials—such as the best one of two trials, the best one of three trials, or the best two of three trials—seems to be a popular method (1, 4, 7, 8, 12, 13, 14). In addition an average of "N" number of trials has been used by several authors (3, 5, 6). Henry (6) concludes that for the Sargent test the average of several trials seems to be more reliable and more valid than the best of several trials.

As indicated in Table 1, high coefficients of reliability have been obtained for different methods of scoring tests of physical ability; however, it will be noted that there is considerable variation among these reliabilities. Inasmuch as these coefficients of reliability were obtained on different subjects and under

TABLE 1
Test Reliabilities

Method of Scoring	Jump and Reach	Dash	Standing Broad Jump	Softball Throw for Distance
One trial only	0.87 (1)*	0.66 (1)		
Best one of two		0.97 (7)	0.83 (1)	0.65 (1)
			0.96 (7)	
			0.91 (14)	0.91 (14)
Best one of three	0.77 (8)		0.88 (12)	0.91 (4)
	0.89 (13)			
Best two of three	0.85 (8)			
Average of three	0.78 (6)			
	0.88 (6)	0.84 (3)	0.96 (3)	
Method not indicated	0.90 (2)	0.67 (2)	0.80 (2)	
	0.91 (2)	0.70 (2)	0.67 (9)	
	0.96 (4)	0.79 (9)	0.98 (11)	
	0.98 (10)			
	0.98 (11)			

* Numbers in parentheses refer to references listed at the end of the article.

varying conditions, no conclusions may be drawn regarding the best method to be used. A comparison of methods should be made on tests administered to the same group.

It is the purpose of this study to compare the reliabilities of certain tests of physical ability when scored by the following methods:

(1). One trial only.
(2). Average of three trials.
(3). Median of three trials.
(4). Best one of three trials.
(5). Average of two trials.
(6). Best one of two trials.

Procedure

SUBJECTS

One hundred and twenty-eight seventh grade boys were used as subjects for this study. These students were enrolled in three separate physical education classes at the University Junior High School in Austin Texas. The ages of these boys ranged from 11 years to 14 years, with 108 of them being between 12 and 13 years.

TESTS

Six different tests were administered to each of the 128 boys. These tests, together with a brief description of the directions for administration, are as follows:

(1) *50-yard dash.* The time for the 50-yard dash was obtained to the nearest one tenth of a second. Subjects ran two at a time, with a separate timer for each subject. A verbal command was used for the starting signal, with a simultaneous hand signal for the timers.

(2) *Standing broad jump.* The standing broad jump was measured to the nearest inch and scores were recorded in inches. Measurements were made with a tape measure from the "scratch line" to the nearest point of contact of any part of the body.

(3) *Softball throw for distance.* Scores for the softball throw were recorded to the nearest foot. The throwing area was marked off with parallel lines 20 feet apart and the distance between lines was measured with a bamboo pole marked off in feet. Measurement was made to the point where the ball first hit the ground. A restraining line was placed 8 feet behind and parallel to the throwing line, and subjects were required to complete the throw within this space. Any type of throw was allowed.

(4) *Jump and reach.* The jump and reach was scored to the nearest inch and recorded in inches. The apparatus for measuring the jump consisted of a piece of blackboard 1 foot wide and 4 feet long. White lines were drawn across the width of the board 1 inch apart with each line numbered accordingly. The board was suspended against a wall so that it could be raised and lowered. As the subject assumed his position beneath the board with his arm raised as high as possible and with fingers fully extended, the board was adjusted so that the zero line was on the level with the tip of the fingers. The subject then jumped as high as possible and slapped the board with the finger tips. A wet cloth was provided for the subjects to dampen the fingers before each jump so that a clear imprint would be left on the board.

(5) *Wall volley.* The wall volley consisted of volleying a volleyball against a smooth wall as many times as possible in 10 seconds. The volley was started with a two-hand push pass, and the score was the number of times the ball hit the wall in 10 seconds. If the ball hit the floor, the subject retrieved it and continued the test. The subject was required to remain behind a restraining line 4 feet from and parallel to the wall. Hits made while the subject was beyond the restraining line were not counted.

(6) *Speed shooting.* In the speed-shooting test the subject, using a regulation basketball, shot as many goals as possible in 15 seconds. The score consisted of the total number of goals made. The subject stood immediately underneath the basket, and any type of shot was allowed.

ADMINISTRATION OF TESTS

Three trials were allowed on each of two administrations for each of the six tests. One week elapsed between the two administrations of all the tests except that two weeks elapsed between the first and second administrations of the wall-volley and speed-shooting tests. Each class was divided into squads of approximately ten boys each, and tests were administered by squads so that all members of a squad finished the first trial on each test before subsequent trials were attempted.

This procedure allowed approximately 11 minutes between trials for the 50-yard dash, 5 minutes for the standing broad jump, 5 minutes for the softball throw for distance, 5 minutes for the jump and reach, 6 minutes for the wall volley, and 7 minutes for the speed-shooting test. Students wore the regulation physical education uniform, including tennis shoes, for all of the tests.

Findings and Interpretations

The comparison of the reliabilities of the tests of physical ability when scored by different methods will be based primarily on an examination of the coefficients of correlation between the scores of the first and second administrations. For example, the average of three trials in the first administration was correlated with the average of three in the second administration.

In order to ascertain whether or not there is any relationship between variability and the type of scoring methods used, coefficients of variation were computed for each of the tests when scored by each of the different methods and for each of the three trials within both administrations of the tests. Also, coefficients of variation of the differences between the highest and lowest scores among the three trials for each individual were obtained for each administration as measures of the variability from trial to trial. These coefficients of variation were computed by dividing the standard deviation of the differences among three trials by the mean of the average of three trials.

In addition, critical ratios of the differences between the means of the first and second administrations were calculated for the different methods and critical ratios were obtained for the differences among the means of the three trials in each of the two administrations as a possible indication of whether learning or fatigue had occurred during the administration of the tests.

The means and coefficients of variation for each of the six methods of scoring and for each of the three trials of both administrations of the tests are presented in Table 2. A comparison of the coefficients of variation among the six tests reveals that the group was decidedly most variable on speed shooting, with wall volley being second highest. This is possibly due to the fact that these two tests involve motor patterns in which seventh grade boys are not likely to have had common experiences as they have had in running, jumping, and throwing. Although no definite pattern of variability is apparent for the

TABLE 2

Means and Coefficients of Variation

Trials	50-Yard Dash		Standing Broad J.		Softball Throw Dist.		Jump and Reach		Wall Volley		Speed Shooting	
	M	C.V.	M	C.V.	M	C.V.	M	C.V.	M	C.V.	M	C.V.
First Trial, First Administration	8.4	7.8	63.8	10.7	109.8	20.3	11.7	18.2	11.4	25.6	2.8	58.2
Second Trial, First Administration	8.5	7.5	64.2	11.2	110.9	21.9	12.0	16.9	11.9	26.2	3.1	58.3
Third Trial, First Administration	8.6	7.5	64.4	11.1	113.3	20.9	12.1	17.7	12.7	24.3	3.3	57.8
First Trial, Second Administration	8.4	7.3	64.6	11.2	109.3	22.4	12.3	18.8	11.7	25.9	2.9	54.2
Second Trial, Second Administration	8.6	7.5	64.3	11.3	109.9	21.9	12.6	17.2	12.1	23.7	3.2	54.5
Third Trial, Second Administration	8.6	7.6	64.5	11.5	110.9	21.7	12.6	17.1	12.8	22.8	3.4	49.6
Average of Three, First Administration	8.5	7.4	64.1	10.2	110.9	21.1	11.9	16.8	11.9	22.4	3.0	47.5
Average of Three, Second Administration	8.6	7.3	64.4	11.1	109.9	21.4	12.5	17.2	12.3	23.8	3.2	48.7
Median of Three, First Administration	8.5	7.4	64.3	10.7	111.6	21.3	12.0	16.7	12.1	24.1	3.1	50.3
Median of Three, Second Administration	8.5	7.3	64.5	11.2	110.2	21.6	12.5	16.9	12.2	22.1	3.2	48.4
Best of Three, First Administration	8.3	7.6	66.4	10.4	116.4	19.9	12.6	16.4	13.6	19.4	4.1	40.3
Best of Three, Second Administration	8.4	7.0	66.3	10.8	114.5	21.4	13.1	16.8	13.3	21.0	3.9	43.0
Average of Two, First Administration	8.5	7.5	64.2	10.4	110.1	21.0	12.1	16.5	12.0	23.6	3.2	45.3
Average of Two, Second Administration	8.5	7.1	64.4	11.2	110.2	21.5	12.7	17.2	12.3	23.3	3.3	47.9
Best of Two, First Administration	8.3	7.5	65.5	10.5	113.3	20.1	12.3	16.2	12.6	22.8	3.7	42.7
Best of Two, Second Administration	8.4	7.1	65.5	11.2	112.4	21.9	12.8	17.1	12.6	22.1	3.6	46.2

TABLE 3

Critical Ratios (t) of the Means[1]

Trials	50-Yard Dash		Standing Broad Jump		Softball Throw Dist.		Jump and Reach		Wall Volley		Speed Shooting	
	Dif	t	Dif	t	Dif	t	Dif	t	Dif	t	Dif	t
	M											
First Trial—Second Trial, First Adm.	0.06[2]	2.2	0.46	1.2	1.16	1.5	0.26	2.4	0.50	2.3	0.27	1.6
First Trial—Third Trial, First Adm.	0.18[2]	5.6	0.63	1.8	3.49	4.1	0.35	3.2	1.28	5.1	0.45	2.8
Second Trial—Third Trial, First Adm.	0.12[2]	4.9	0.17	0.5	2.33	2.6	0.09	0.9	0.78	3.3	0.18	1.1
First Trial—Second Trial, Second Adm.	0.13[2]	4.3	0.26[2]	0.9	0.54	0.7	0.27	2.9	0.36	2.3	0.24	2.2
First Trial—Third Trial, Second Adm.	0.21[2]	7.6	0.08[2]	0.0	1.62	1.9	0.28	2.8	1.05	6.0	0.46	4.3
Second Trial—Third Trial, Second Adm.	0.08[2]	3.0	0.18	0.7	1.08	1.5	0.01	0.1	0.69	4.4	0.22	2.3
First Trial—First Trial	0.01	0.3	0.79	2.0	0.46[2]	0.5	0.62	4.5	0.30	1.8	0.13	1.4
Average of Three—Average of Three	0.04[2]	1.9	0.35	1.4	0.93[2]	1.3	0.59	5.8	0.30	2.5	0.11	2.2
Median of Three—Median of Three	0.04[2]	1.4	0.21	0.7	1.31[2]	1.4	0.59	7.7	0.15	1.2	0.12	1.7
Best of Three—Best of Three	0.03[2]	1.1	0.05[2]	0.0	1.94[2]	2.4	0.51	5.7	0.33[2]	2.9	0.24[2]	2.9
Average of Two—Average of Two	0.05[2]	1.9	0.23	0.8	0.08[2]	0.1	0.60	5.9	0.30	2.2	0.16	2.2
Best of Two—Best of Two	0.04[2]	1.4	0.04	0.0	0.93	1.1	0.55	5.2	0.06[2]	0.4	0.13[2]	1.5

[1] 2.616—significant at the 1 per cent level; 1.979—significant at the 5 per cent level.
[2] Best performances were obtained in the first administration or first trial mentioned.

different types of scoring, the coefficients of variation tend to be smallest for the best of three and best of two scores.

In Table 3 are shown the critical ratios of the differences between the means for the different methods of scoring and for the three trials in each of the two administrations of the tests. These ratios are based on the standard error of the difference between means computed by the formula for correlated data. In examining the differences among the means of each of the three trials on both administrations of the tests, especially those differences between successive trials, it is seen that the most significant differences occur in the 50-yard dash. The decided decreases may be due to fatigue or inadequate motivation, particularly on the third trial.

Very significant increases are noted especially for the wall volley and speed shooting tests, indicating that possibly learning occurred during these tests. Such increases are not surprising for these activities which were relatively new for most of the subjects. Difficult to understand, however, are the marked increases between the first and second trials on both administrations of the jump and reach and between the second and third trials of the first administration of the softball throw for distance, especially in view of the fact that ample warm-up was provided for each test.

More pertinent to the purpose of this study is a consideration of the differences between the corresponding means of the first and second administrations for each of the six methods. There does not seem to be any consistent pattern for any one of the six methods; on the other hand marked variations are noted among the different tests when scored by the different methods.

Readily apparent in an examination of these critical ratios are the very significant increases in the second administration of the jump and reach over the first administration. Although learning could possibly have occurred, it is hardly plausible that the group would have improved their performance so much more in this than in the other tests, especially in the wall volley and speed shooting.

Rather it is possible that such differences may be due to errors in administration. The accuracy of the measurement in the jump and reach was dependent on "zeroing" the board at the maximum "reaching height" of the subject. Such procedure is most difficult at times, especially with those students who are aware that they can obtain better scores by not reaching as far as possible in the "zeroing" process.

Other significant differences include a significant difference at the 5 per cent level for the wall volley and speed shooting when scored by the average of three and average of two methods and at the 1 per cent level when scored by the best of three methods. This indicates still further that learning has occurred in these tests. The only other significant differences are for the softball throw for distance when scored by the best of three and for the standing broad jump when scored by one trial only, with the differences for the average of three and average of two approaching significance at the 5 per cent level in the 50-yard dash.

As revealed by the coefficients of correlation in Table 4, the average of three methods in general yields the highest reliabilities, with only slightly lower reliabilities for the best of three and median of three methods. The coefficients for one trial only are lowest for every test and in only one instance, that of the average of two trials for the 50-yard dash, does a combination of two trials rank higher than third among the methods. The intercorrelations among the three trials of each administration of the tests are fairly consistent except for the wall volley and speed shooting tests. Marked increases in the coefficients of the second administration over the first administration indicate an improvement in consistency of performance, again emphasizing the lack of initial familiarization with the tests.

TABLE 4
Coefficients of Correlation

Trials	50-Yard Dash	Standing Broad Jump	Softball Throw Dist.	Jump and Reach	Wall Volley	Speed Shooting
First Trial—Second Trial, First Adm....	0.886	0.818	0.933	0.825	0.662	0.421
First Trial—Third Trial, First Adm.....	0.845	0.831	0.914	0.833	0.556	0.474
Second Trial—Third Trial, First Adm...	0.905	0.858	0.908	0.839	0.640	0.477
First Trial—Second Trial, Second Adm..	0.855	0.902	0.930	0.889	0.803	0.737
First Trial—Third Trial, Second Adm...	0.882	0.877	0.920	0.874	0.783	0.720
Second Trial—Third Trial, Second Adm..	0.893	0.913	0.944	0.904	0.815	0.792
First Trial—First Trial.....	0.832	0.797	0.892	0.758	0.798	0.798
Average of Three—Average of Three....	0.931	0.918	0.940	0.851	0.885	0.931
Median of Three—Median of Three.....	0.861	0.899	0.905	0.914	0.883	0.876
Best of Three—Best of Three.....	0.876	0.916	0.927	0.889	0.888	0.848
Average of Two—Average of Two.....	0.886	0.882	0.905	0.854	0.851	0.865
Best of Two—Best of Two.....	0.864	0.845	0.915	0.844	0.850	0.817

No marked relationship is readily discernable between the sizes of the coefficients of variation and the coefficients of reliability. In general the largest coefficients of variation were obtained for single trials and the single trial method yielded the smallest coefficient of correlation in every test. However, it will be remembered that in general the smallest coefficients of variation were obtained for the best of three trials and the largest coefficients of reliability were found for the average of three.

One often hears the comment that when scores on a test vary considerably from trial to trial for each individual, the most desirable method of scoring to use is the sum or average of all trials. Coefficients of variation of the differences between the highest and lowest scores among the three trials of each administration were obtained as indications of this type of variability. These coefficients for the first and second administrations respectively for the six tests are as follows: 50-yard dash, 2.6 and 2.8; standing broad jump, 4.7 and 3.6; softball throw for distance, 7.0 and 6.5; jump and reach, 7.0 and 6.5; wall volley, 15.8 and 11.6; and speed shooting, 43.1 and 23.1.

The pattern of these coefficients of variation of the differences is quite similar to that of the coefficients of variation of the entire distribution previously discussed. It would seem, therefore, that the average of two or three trials is not necessarily the best method to use in tests in which there is marked variation in scores from trial to trial.

Summary and Conclusions

Six tests of physical ability were administered to 128 junior high school boys for the purpose of comparing different methods of scoring; such as, one trial only, average of three trials, median of three trials, best one of three trials, average of two trials, and best one of two trials. The tests of physical ability are the 50-yard dash, the standing broad jump, the softball throw for distance, the jump and reach, a wall volley, and speed shooting. Three trials were allowed for each test on each of two administrations.

A consideration of the coefficients of variation, critical ratios of the differences between the means, and coefficients of correlation, computed for the different methods and for different trials within each administration reveal the following:

1. The group was most variable on the speed shooting test, with the wall volley being second highest.
2. Although coefficients of variation tended to be smallest for the best of three and best of two methods, there appears to be no definite pattern of variability for the different methods of scoring.
3. The most marked differences between the means were very significant differences among the three trials on each of the two administrations of the 50-yard dash and very significant differences between means of the first and second administrations of the jump and reach for the different methods of scoring.
4. In general the highest coefficients of correlation were obtained for the average of three methods with only slightly lower reliabilities for the best of three and median of three methods. The coefficients for one trial only were lowest for every test.
5. There does not appear to be any marked relationship between the size of the coefficients of reliability and the variability of the individual trials of the tests or the variability of the differences between the highest and lowest trials.

A determination of the method of scoring of those physical ability tests used in this study might well be contingent upon a consideration of other criteria of tests, such as administrability, scorability, economy of time, and validity. It would seem that the best of three or median of three would be acceptable methods. These methods yield high reliability coefficients, and the use of the best of three particularly would facilitate the administration and scoring of these tests.

It is doubtful whether single trials or combinations of two trials should be used except perhaps for the 50-yard dash, where the best of two scores and even one trial scores yielded high coefficients of reliability. Marked decreases

on the second and third trials and the excessive time required to administer three trials for this test substantiate this contention.

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Short Batteries of Tests Measuring Physical Efficiency for High School Boys

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Certain basic assumptions have been widely accepted in the field of physical education. These may be stated as follows:

1. The primary objectives of any program of physical education are the promotion and maintenance of strength, endurance, explosive power, co-ordination, agility, speed, and balance as constituting a functionally desirable form of physical development.
2. The measurement of status and progress in physical development is both feasible and essential.
3. Tests should conform to the objectives sought in any program.
4. Tests should measure a wide variance in the degree of achievement of objectives, both for the pupil and the instructor.

The Problem

There is little doubt that testing, as an educational tool, has been neglected in many small high schools. As a result, the pupils lack definite objectives and the instructor is unable to assess the effectiveness of his program. However, it should be possible to set up short batteries of tests of motor ability capable of easy administration to large or small groups under the normal handicaps of limited space and scarcity of equipment.

Test items should conform to the following requirements:

1. Reliability—A test should be consistent in measurement.
2. Simplicity and economy—A test must be capable of rapid and efficient administration to large groups without expensive or complicated apparatus.
3. Interest—A test should appeal to the competitive instincts of the subjects.
4. Experience and development—A test should contribute to the experience and physical development of test subjects.
5. Validity—Lacking adequate criteria, the fidelity with which a test measures what it purports to measure may be assessed satisfactorily through exercise of informed subjective judgment.
6. Norms—Test scores should represent individual performance in relation to norms established for the particular group classification.

In the attempt to evaluate possible testing media, it was proposed to administer some 20 tests to approximately 100 college men. Although sound objection to the importance of some of these test items might later appear, it

was believed that a composite score from all tests would serve as an adequate criterion (Cozens, 1) of physical ability. Determination of the regression coefficient of each test would indicate its relative importance and thus serve as a guide to be used, along with other considerations, in grouping test items into short batteries. Reliabilities of each test would be calculated by the re-test method. The multiple correlation technique would then be used to determine the predictive ability of each short battery with respect to the criterion.

Setting Up the Experiment

Students in the required physical education classes at Colorado A & M College volunteered their services to provide the data necessary for statistical analysis of the tests. The purpose of the experiment was explained and the methods to be followed were outlined. Since it was obvious that it would require a couple of months to administer and modify as many tests as were contemplated, the number of volunteers from any one class was limited to 15. This was done so normal progressive class activities would not be seriously hindered. In addition, small groups could more easily learn the techniques involved in performing the test activities and time would be available for discussion with the subjects as to their reactions to the tests.

One hundred and thirty-four students volunteered from ten different classes meeting three times each week. Although no attempt was made to screen the subjects as to ability, it must be admitted that the volunteers probably constituted a group which was somewhat above the general average in physical ability, in interest in their own physical welfare, and possibly in intelligence. However, this did not appear to be important since norms established by college men would not be applicable to high school boys.

A high degree of co-operation and interest was maintained by the students who volunteered as test subjects. Of the 134 who signed up to assist with the experiment, 123 completed both administrations of all tests finally adopted. Those who dropped out were forced to do so because of illness or injury.

The general plan of operation would be as follows: A test would be described and demonstrated, its purpose would be explained, it would be administered experimentally to the group, and any desirable modifications would be tried out. Discussion would be confined primarily to the objectivity of the tests; in other words, to the standardization of administration. However, general suggestions and criticisms would also be considered. Following this, subjects would be given an opportunity to familiarize themselves with the skills and techniques of the test. It would then be administered to each subject in turn. Dependent upon the type of test and the time available, the re-test would be given either later the same period or at the next meeting of the class.

Description of Test Items

For purposes of analysis, 19 tests were finally adopted as having some merit. Complete descriptions of these tests follow:

1. *Squat Twist:* Body agility, co-ordination.

Equipment: Stopwatch and piece of chalk.

Set-up: Subject stands with his back to the wall. Draw a straight horizontal line with chalk on the wall at the height where the neck border of his gym shirt rests on his shoulders in normal position. He then stands sidewards to the wall, feet parallel and together at such a distance that he may touch the wall with the palm of his near hand with the elbow held straight. Make a mark on the floor in line with the edge of his foot nearest the wall.

Starting position: Subject stands with his back to the wall, his feet beyond the mark on the floor, and his fingers touching the floor. He may have his feet as far apart as he wishes.

Administration: On the starting signal, the watch is started and the subject straightens up and twists to the right to touch the wall with the fingers of both hands. At least one hand must touch above the horizontal line. He then returns through the starting position—touching the floor again with both hands—and continues to touch the wall to his left with both hands with the same restrictions. This movement is continued as rapidly as possible until the test is completed by touching the wall to his left for the tenth time. Score in tenths of seconds. In each case, the wall touch must be made with both hands but only one hand must touch above the horizontal line, and the floor touch must be made with both hands between each wall touch.

2. *Sitting Medicine Ball Throw:* Explosive power of the arms.

Equipment: Measuring tape and five-pound medicine ball. To construct this medicine ball, take a discarded basketball and rip open the seams for four or five inches. Cut up some old rags and stuff them inside until the weight is correct, then sew up the ripped seam. The seam may be sewed on the outside, since roughness of the cover is unimportant. Such a ball will be found to be a valuable piece of equipment for developmental and recreational purposes.

Starting position: Subject sits either on the floor or on a mat behind the throwing line with his back toward the direction of throw.

Administration: Subject may swing the ball down between his legs, bend his knees or hips, or use any technique he wishes in throwing or preparing to throw. However, the throw must be made straight backward, overhead, with both hands together. He may flex his body as much as he wishes and he may also extend the body until he reaches a supine position on the floor or mat. Practice throws may be allowed. When he states his readiness for measurement, three consecutive throws are made, measured to the closest inch. The longest legal throw is recorded as his score.

3. *Standing Broad Jump:* Explosive power of the legs.

Equipment: Measuring tape and mats or jumping pit.

Set-up: If test is given indoors, mats should be used. These mats should be secured so they will not slip. If inch lines can be painted on the mats, it would speed the administration of the test. If given outdoors, a sand or sawdust pit should be provided at a suitable distance from the take-off mark. Jumps as short as five feet and as long as nine feet should be anticipated.

Administration: Subject stands on both feet behind the take-off mark. He jumps as far forward as possible. Measure to the nearest inch, using the standard technique in measuring jumps in track meets. After practice trials, the subject makes three consecutive jumps, the longest legal jump being recorded as the score for the test. He may not crow hop or step in making the jump.

4. *Push Shot:* Explosive power of the arms.

Equipment: Five-pound medicine ball and measuring tape.

Starting position: The subject sits facing the throwing area with his body in back of the throwing line and the feet and legs extended forward.

Administration: The throw must be made with both hands together as in the two-hand push pass in basketball. Practice throws may be allowed. Three consecutive throws are made for distance, measured to the nearest inch. The longest legal throw is recorded as his score.

5. *Wall Bounce Test:* Hand-eye co-ordination and speed.

Equipment: A basketball and a stopwatch.

Set-up: Draw a restraining line ten feet in front of a blank wall.

Administration: At the starting signal, the watch is started and the subject throws the ball at the wall from behind the restraining line. As it returns, he must catch it and again bounce it against the wall. This continues until he catches it for the tenth time. He must stay behind the restraining line at all times during the test. He may bat or throw the ball—the object being to bounce it against the wall as rapidly as possible. The watch is stopped as the subject catches the ball for the tenth time. Score in tenths of seconds.

6. *Standing Medicine Ball Throw:* Explosive power of the arms, strength of back and shoulder girdle extensors and general body co-ordination.

Equipment: Measuring tape and five-pound medicine ball.

Set-up: Use the four-foot center jump circle marked on your basketball floor, or a circle of the same size marked out in any convenient location. In line with the direction of throw, stretch out the measuring tape or mark out one-foot lines with chalk or lime. The tape, if used, should be lightly taped to the floor at frequent intervals. A possible throw of 75 feet should be anticipated.

Starting position: Subject stands inside the circle, facing away from the direction of throw, He holds the medicine ball in both hands preparatory to throwing it backward overhead.

Administration: Subject may swing the ball down between his legs, bend his knees or hips or use any technique he wishes in throwing or preparing to throw. However, the throw must be straight backward, overhead, and made with both hands together. He must stay within the circle in making a legal throw. He should be permitted to take a practice throw or two if he desires. When he states his readiness for measurement, he makes three consecutive throws which are measured to the nearest six inches from the nearest edge of the circle to the point where the center of the ball touches the floor. The longest legal throw is recorded as his score. The subject should be advised as to the best techniques in throwing. For instance, a common fault is to hang on to the ball too long. This results in a throw which is too low, whereas a higher throw would carry farther. The scorer should stand about as far away as he expects the ball to carry so that he can immediately sight across its landing position to the tape in order to determine the distance without delay. If the next test subject will make his practice throw by throwing the ball back to the current thrower, it will speed up the administration of the test. (For college students, a heavier medicine ball should be used.)

7. *Potato Race:* Agility and speed.

Equipment: Stopwatch.

Set-up: Use the free-throw circle marked on your basketball floor or a similar circle marked out in any convenient location.

Starting position: Subject straddles the circumference of the circle at the point where free throw line touches it.

Administration: At the starting signal, the watch is started and the subject moves across the circle along the free-throw line to touch one foot outside the circle on the opposite side and returns in the same manner to the starting position. This is continued for five round trips. The test ends and the watch is stopped as either foot crosses the circumference of the circle on the completion of the fifth round trip. Score in tenths of seconds. The subject may use any method of locomotion he desires, but no marked deviation from the free throw line is permitted in traveling across the circle. He must touch the floor outside the circle in each case before reversing the direction of movement.

8. *Dodge Run:* Agility and speed.

Equipment: A stopwatch and five chairs.

Set-up: Use any convenient line as a base line. This line should be far enough from the wall to permit a test subject to run across it at full speed at the end of the test. Make two marks 20 feet apart on the base line. Perpendicular to these marks, make two other marks 30 feet

beyond the base line. Midway between the last two marks and in line with them, make another mark. Place five chairs so that one is centered on each of the five marks. The left-hand chair on the base line will be referred to as number one; the second chair will be the one perpendicular to it; the middle chair of the three in line will be number three; and the next chair to the right will be number four; the right-hand base line chair will be number five.

Administration: At the starting signal, the watch is started and the subject starts from behind the base line inside of chair number one; he runs forward to the left of number two, turns right and passes to the right of number three, to the left of number four, and turns right to run across the base line inside (to the right) of number five; immediately he turns around and retraces his course to finish as he crosses the base line inside of chair number one. In crossing the base line the first time, alongside chair number five, the subject is required only to step over the line with one foot before reversing his direction. The watch is stopped as the subject crosses the base line at the finish of the test. Score in tenths of seconds.

9. *Block Transfer: Agility and hand-eye co-ordination.*

Equipment: Stopwatch and ten wooden cubes, 2 x 2 x 2 inches or slightly smaller.

Set-up: Two circles with nine-inch radius are drawn or painted on the floor with their centers eight feet apart. Midway between them and perpendicular to their common axis, a straight line approximately three feet long is drawn as a center line. In one of the circles, the ten cubes are placed. These may be arranged in any pattern desired by the test subject so long as they are all inside the circle.

Starting position: The subject takes a standing or crouching position with both feet on the floor on the opposite side of the center line from the circle containing the cubes.

Administration: At the starting signal, the watch is started and the subject moves across the center line with both feet to pick up one of the cubes. He then moves back across the center line to deposit that cube in the other circle. Immediately he returns across the center line to get another cube which, in turn, he carries across the center line to be deposited in the other circle. This process is repeated until all the blocks are moved, one at a time, from the first circle into the second one. The watch is stopped the instant the last cube is deposited in the second circle. In depositing the cubes in the second circle, they must be laid or dropped—not thrown—and they must remain inside that circle. If any cubes are on or outside the circumference line of the circle, they must be pushed inside before the watch is stopped at the end of the test. Score in tenths of seconds.

Restrictions: (1) Only one cube may be moved at a time. (2) Both feet must touch the floor on the proper side of the center line in moving from one circle to the other. (3) All cubes must be *inside* one circle at the start of the test. (4) All cubes must be *inside* the other circle at the end of the test.

Suggestions: The cubes may be picked up and laid down by the same hand or they may be transferred from one hand to the other, at the option of the test subject. The subject may transfer from right to left, or from left to right, as he desires. The subject should keep his feet well apart in landing across the center line in order to maintain his balance. Keeping the legs well bent and the buttocks low will speed up the time required to make the transfer. The subject should keep his eyes on the cubes, both in picking them up and laying them down. A reasonable amount of practice should be allowed before the subject is officially timed on the test. The test should be given on a surface which is not slippery, and the subjects should wear good shoes. Only in exceptional circumstances should a retrial be permitted. For junior high school students, and probably for college women, seven feet between the centers of the circles is a more satisfactory distance.

10. *Squat-Stretch:* Agility and speed.

Equipment: Stopwatch.

Set-up: Draw or paint a series of sets of circles with four-inch radii as follows: One set consists of a circle on the floor centered 30 inches from the wall, with another circle on the wall directly above, centered 68 inches from the floor. Other sets have their circles centered respectively 32 inches from the wall and 72 inches from the floor; 34 inches from the wall and

76 inches from the floor, etc. Leave at least three feet between sets of circles. Make other sets for shorter or taller boys as necessary. It is probable that the three sets suggested will be sufficient for most groups. Determine the set which any subject should use by having him stand alongside the wall circles with one arm stretched overhead. The set of which the top of the wall circle is approximately the height of the heel of the hand is the set he should use.

Starting position: The subject stands with either side toward the wall, straddling the floor circle and with the closer hand touching any part of the wall circle. The other hand is on his hip.

Administration: At the starting signal, the watch is started and the subject bends down to touch the floor within the circle straddled by his feet. He immediately rises to retouch the wall circle and continues this same movement as rapidly as possible until he has touched each circle in turn ten times, not counting the starting position as a touch. The watch is stopped as he touches the wall circle for the tenth time. If his right side is toward the wall, he uses only the right hand in making the touch within the circles while the left hand must remain on his hip and his feet must remain in place throughout the test. He may touch any part of the circles with any part of his hand or fingers. Score in tenths of seconds.

11. *Circle Scramble:* Agility and co-ordination.

Equipment: Stopwatch.

Set-up: Using a common center, draw two circles on the floor, the radii of which shall be six inches and three feet. Thus there will be a circle with a diameter of one foot inside a circle with a diameter of six feet. Draw a radius from the center to extend about three feet beyond the circumference of the outer circle.

Starting position: The subject takes a front leaning rest position with his hands inside the inner circle and his feet straddling the extended radius line outside the outer circle. During the entire test, both hands must remain in contact with the floor inside the inner circle and the feet must at all times extend beyond the outer circle. No other part of the body may touch the floor except the feet and hands.

Administration: At the starting command, the watch is started and the subject starts to revolve his feet around his hands to make a complete circle in either direction. Completion of the first circle is accomplished when either foot crosses the extended radius. He immediately reverses his direction to make a circle in the other direction. Upon completion of the second circle, he again reverses direction to make a third circle in the same direction as the first circle. The test ends and the watch is stopped as either foot crosses the extended radius to mark the completion of the third circle. Score in tenths of seconds. It is no violation if part of either hand should extend over the circumference of the inner circle, but both hands must maintain some contact with the floor inside the inner circle at all times during the test.

12. *Combined Speed Test:* Speed of muscular contraction of the arms and legs.

Equipment: Stopwatch and a board or barrier similar to a hurdle, twelve inches high and two to three feet long.

Set-up: The test is divided into two parts, using the same equipment for each.

Measuring arm speed: The subject kneels at one end of the barrier with either hand he wishes to use touching the mat alongside. At the starting signal, the watch is started and the subject passes his hand over the barrier to touch the mat on the opposite side. Passing his hand over the barrier each time, he touches the mat on alternate sides of the barrier as rapidly as possible until he has made ten round trips. As he touches the mat on the original side for the tenth time, the watch is stopped and the time is recorded in tenths of seconds.

Measuring leg speed: The subject stands at the end of the barrier with the toe of either foot he wishes to use touching the mat alongside. He may grasp any support with one or both hands in order to maintain his balance. At the starting signal, the watch is started and the subject raises his foot, passes it over the barrier and touches the mat on the opposite side. This movement is continued back and forth as rapidly as possible until ten round trips are concluded. As he touches the mat on the original side for the tenth time the watch is stopped and the time is recorded in tenths of seconds.

Scoring: The arm speed plus the leg speed constitutes the score for the combined speed test.

13. *Vertical Jump:* Explosive power of legs.

Equipment: Vertical jump standard and tape measure. Plans for the construction of a suitable standard are seen in the accompanying diagram. (Fig. I). Use of such a standard will speed up the administration of the test. Chalk dust on the fingers will make a satisfactory mark for measuring purposes or dampening the fingers will serve the same purpose.

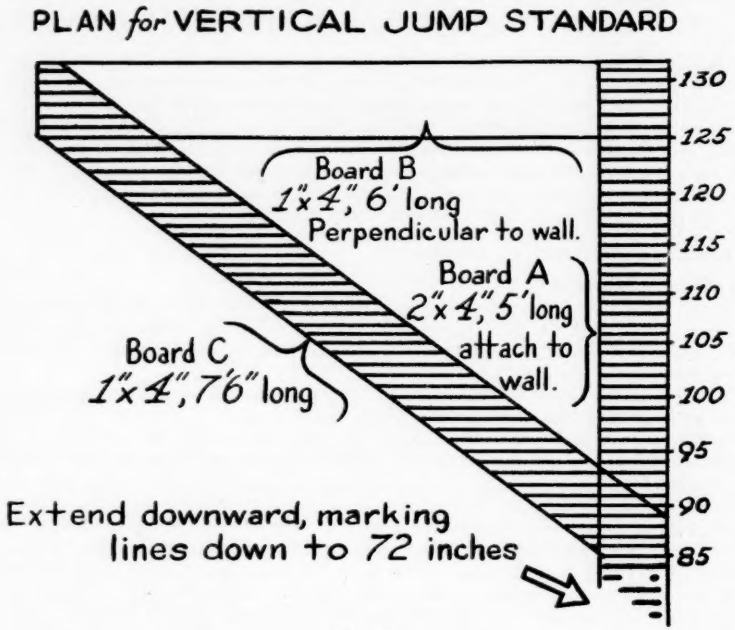

FIG. 1

Set-up: Record each subject's standing reach in the following manner: He stands sidewards to a wall with both heels together on the floor and with the arm nearest the wall fully extended overhead. Record, to the nearest one-half inch, the distance from the floor attained by the tip of the longest finger. To facilitate measurement, distances can be marked on a cardboard or piece of oilcloth which is then attached to the wall. The subject reaches up on this marker and the constant use of a tape measure is avoided. If the standard is constructed according to the plan, the marks on the 2 x 4 upright will serve to measure the standing reach.

Administration: From a stationary position under the standards, the subject jumps and reaches as high as possible to make a mark with his fingers on the marker of the standards. He may take practice jumps, but when he is ready, he makes three consecutive jumps for measurement. These jumps are not to be continuous; that is, there should be a pause of at least ten seconds between jumps. The highest jump of three, measured to the nearest one-half inch, is recorded. From this is subtracted his standing reach. The difference is recorded as his score for the test. The jump must be made from a stationary position; he may not step or crow-hop. *Note:* Other types of vertical jump standards are in use which would undoubtedly be just as satisfactory as these suggested.

14. *Block Balance:* Balance.

Equipment: Stopwatch and a balance standard constructed as follows: A base block 12″ square, 1½″ thick, a piece of 2 x 2 extending two or three inches vertically from the center of

the base. This is rigidly set on the base and is slightly rounded on the upper surface.

Starting position: The subject places either foot on the block in the area of the ball of the foot. The arms may be held in any position desired.

Administration: The subject may make as many attempts as he wishes to achieve a balance satisfactory to himself in the starting position. When he is satisfied, he says "go," and the watch is started. This marks the actual beginning of the test. Time continues until any part of the body touches the floor. Score in tenths of seconds.

15. *Hand Transfer:* Hand-eye co-ordination.

Equipment: Stopwatch, two boxes approximately one foot square with dies not more than four inches high, and 20 cubes approximately 2 x 2 x 2. Ten of the cubes should be painted a light color and ten dark.

Set-up: The subject sits or kneels on the floor with one box on his right side and the other box on his left side. The boxes should be placed so that he can reach into them conveniently. In one box are placed the ten light colored cubes and in the other are placed the dark colored cubes. The adjacent edges of the boxes should be 18 inches apart.

Starting position: Subject sits with both hands in his lap.

Administration: Assume that the light colored cubes are in the right hand box; subject picks up a light colored cube with his right hand, transfers it to his left hand and places it in the left hand box; he then picks up a dark-colored cube with his left hand, transfers it to his right hand and places it in the right-hand box; he continues this process until all the light-colored cubes are in the left-hand box and all the dark-colored cubes are in the right-hand box. As the last cube is deposited in the proper box, the watch is stopped. Score in tenths of seconds. Each cube must be picked up and deposited by the proper hand and transferred from one hand to the other in passage. *Note:* This test has very poor reliability until it has been practiced a number of times.

16. *Chinning:* Strength and endurance of shoulder girdle and arm flexors.

Equipment: A horizontal bar, high enough that no subject will be able to touch the floor with his feet while hanging by his hands.

Starting position: Subject hangs by his hands from the bar, arms fully extended, using any grasp he desires.

Administration: Subject raises himself to a point where his chin is over or level with the bar and then lowers himself again to full arm extension. Excessive swinging may be stopped by the scorer but there is no restriction on kicking or bending the legs. If the subject fails to come down to full arm extension at any time, the next pullup is to be counted as one half. The count should be made aloud so the subject will know when he is being penalized. The subject should not be permitted to work so fast that the scorer is unable to determine accurately the attainment of the proper positions. Many times the subject will be unable to reach the top position on his last attempt; if he raises himself to a point where his eyebrows are level with the bar, he is to be credited with one-half pullup. Note that this applies only to the last attempted pullup. His score shall be the total number of legal chins and half chins. The subject may not be allowed to pause for more than five seconds at any time during the test. Be sure that the subject understands that he must completely extend his arms in the lower position before starting the next pullup. Watch this carefully if he is using the reverse grasp. Each subject should be informed of the penalty for infraction of any restriction.

17. *Dipping:* Strength and endurance of the arms.

Equipment: Parallel bars or similar standard constructed high enough that no subject will be able to touch the floor with his feet when his arms are fully flexed.

Starting position: Subject attains an erect position on the parallel bars with the arms fully extended.

Administration: The subject lowers himself to the position of full flexion of both arms. After this position has been attained, the subject returns to the fully extended position of the arms. This constitutes one dip. The subject is not allowed to swing or kick himself up. The rate of

speed is up to the individual, so long as he attains the two required positions. If the subject fails to come to the fully flexed or extended position, he is scored one-half for that particular dip. Once the subject has started the test, he must continue without resting. On the last dip, if he attains the position greater than a 90° angle of the arms, he may be scored one-half for that dip. His score is the total number of dips accomplished.

18. *Bent Arm Hang:* Endurance and strength of the arm flexors.

Equipment: A horizontal bar, a chair, and a stopwatch.

Starting position: The subject stands on any convenient support of sufficient height so that the bar is approximately at the level of his eyes. He grasps the bar with both hands and raises or lowers himself until his eyebrows touch the bar. When he is ready, he raises his feet from the support so that he is holding himself in position entirely by the strength of his arms. The watch is started the instant he takes his full weight on his arms. He must maintain this position with his eyebrows touching the bar as long as possible. The test ends and the watch is stopped when the contact between his eyebrows and the bar is lost or when he makes use of any other support than his arms to maintain the contact. Score in tenths of seconds. Bear in mind that this is primarily a test of endurance. The object is to determine how long the subject can support his entire weight in a definite position using only his arms. If found to be more convenient, the subject can be lifted to the starting position. If this is done, however, the assistant should release his support and the watch should be started on a starting signal by the test subject so that he will not be taken by surprise.

19. *Leg Raiser:* General strength and endurance.

Equipment: Stopwatch and chair, bench, or low bar.

Set-up: With the subject lying on his back on the floor, the chair or bar is placed so that when he raises his legs to touch it with his ankles, his heels will be at least 6 inches from the floor and not more than 12.

Starting position: Subject lies supine on the floor, arms at sides touching the floor, knees straight, legs raised to touch the marker with his ankles. The hands or thumbs may not be under the hips.

Administration: The watch is started the instant the subject assumes the starting position. The watch is stopped as soon as this position is changed by (1) lowering the legs, or (2) bending the knees. Score to the nearest full second.

Collection and Treatment of Data

The tests, as modified, were administered twice to the group. To provide a basis for analysis, reliability, and zero-order, correlation coefficients were calculated. These are presented in Table 1.

The modified T-score $\left(K = \frac{20}{St.\ D.}\right)$ method was then employed to make up point scores for each test item. To arrive at a composite score, the point scores from all tests were added together, using the best performance of each subject. The Doolittle Method (2) was utilized for the derivation of the regression coefficients, and the coefficient of multiple correlation was calculated in order to have a basis for comparison with the multiple R's of the various short batteries.

Analysis of Data

Short batteries of four and five test items were grouped with two factors in mind. The first was the grouping of test items involving the measurable

TABLE 1

Correlation Matrix

*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	0
1	.786																			
2	.350	.877																		
3	.431	.500	.872																	
4	.423	.675	.528	.936																
5	.466	.583	.383	.656	.780															
6	.395	.767	.530	.736	.559	.909														
7	.493	.432	.337	.418	.558	.363	.827													
8	.440	.389	.414	.396	.494	.405	.660	.815												
9	.438	.351	.411	.368	.289	.336	.425	.423	.748											
10	.666	.250	.267	.345	.440	.259	.498	.473	.350	.806										
11	.359	.391	.302	.425	.319	.287	.435	.463	.339	.515	.791									
12	.516	.340	.366	.297	.309	.325	.408	.391	.560	.409	.268	.830								
13	.381	.363	.582	.419	.347	.304	.246	.350	.317	.321	.277	.180	.884							
14	.244	.239	.247	.095	.187	.158	.152	.187	.272	.141	.212	.236	.315	.763						
15	.439	.063	.174	.157	.305	.112	.321	.238	.229	.453	.302	.405	.084	.201	.691					
16	.238	.087	.194	−.003	−.019	−.005	.148	.202	.271	.176	.158	.156	.243	.292	.032	.901				
17	.304	.083	.152	−.019	−.014	−.015	.121	.140	.338	.202	.151	.303	.196	.212	.081	.783	.915			
18	.195	.080	.022	.140	.066	−.108	.032	−.006	.069	.085	.123	.119	.066	.194	.000	.548	.331	.761		
19	.100	−.053	−.067	−.100	−.027	−.092	−.031	.066	.138	.102	.167	.124	−.126	.252	.039	.290	.359	.408	.769	
0	.724	.690	.686	.686	.651	.645	.644	.637	.621	.609	.598	.591	.570	.452	.407	.357	.344	.246	.199	.950

* 1 Squat Twist; 2 Sitting Medicine Ball Throw; 3 Standing Broad Stump; 4 Push Shot; 5 Wall Bounce; 6 Medicine Ball Throw; 7 Potato Race; 8 Dodge Run 9 Block Transfer: 10 Squat Stretch; 11 Circle Scramble; 12 Combined Speed; 13 Vertical Jump; 14 Block Balance; 15 Hand Transfer; 16 Chinning; 17 Dipping; 18 Bent Arm Hang; 19 Leg Raiser; 0 Total Points Combined.

TABLE 2
Regression Coefficients and Multiple Correlation Coefficient

Test Item	No.	Value	Rank
Squat twist	B1	0.1400	3
Sitting medicine ball throw	B2	0.1482	2
Standing broad jump	B3	0.1585	1
Push shot	B4	0.1034	7
Wall bounce	B5	0.0602	14
Standing medicine ball throw	B6	0.0987	9
Potato race	B7	0.1159	5
Dodge run	B8	0.0371	18
Block transfer	B9	0.0791	13
Squat stretch	B10	0.0532	15
Circle scramble	B11	0.0978	10
Combined speed	B12	0.0531	16
Vertical jump	B13	0.1097	6
Block balance	B14	0.1029	8
Hand transfer	B15	0.0831	11
Chinning	B16	0.0829	12
Dipping	B17	0.0119	19
Bent arm hang	B18	0.0379	17
Leg raiser	B19	0.1282	4
Multiple correlation coefficient		0.9834	

elements involved in normal athletic activities. The second was the importance of the test as indicated by its regression coefficient.

These batteries are as follows:

Battery I. This battery was made up of the Standing Broad Jump for explosive power of the legs; Push Shot for explosive power of the arms; Squat Twist for body agility and co-ordination; and the Leg Raiser for strength and endurance. The reliability of this battery was found to be 0.95, with a multiple R of 0.90.

Battery II. This battery was composed of the Push Shot for explosive power of the arms; the Block Transfer for agility and hand-eye co-ordination; and the Leg Raiser for strength and endurance. The reliability of this battery was found to be 0.85. This is considered to be too low for battery reliability and therefore is not recommended.

Battery III. The test items making up this battery were the Standing Broad Jump for explosive power of the legs; the Sitting Medicine Ball Throw for explosive power of the arms; Squat Twist for body agility and co-ordination; and the Leg Raiser for strength and endurance. The reliability of this battery was found to be 0.89, with a multiple R of 0.92.

Battery IV. The Potato Race for agility and co-ordination; Standing Broad Jump for explosive power of the legs; the Push Shot for explosive power of the arms; and the Leg Raiser for strength and endurance were included in this battery. Its reliability was found to be 0.88 with a multiple R of 0.90.

Battery V. This battery was made up of the Standing Broad Jump for explosive power of the legs; Push Shot for explosive power of the arms; the Block Transfer for agility and hand-eye co-ordination; Dipping for strength and

endurance of the arms; and the Leg Raiser for general strength and endurance. The reliability of this battery was found to be 0.90, with a multiple R of 0.88.

Battery VI. This battery was composed of the Standing Broad Jump for explosive power of the legs; Push Shot for explosive power of the arms; Dipping for strength and endurance of the arms; and the Leg Raiser for general strength and endurance. The reliability was found to be 0.93, with a multiple R of 0.91.

Battery VII. The items making up this battery were the Squat Twist for body agility and co-ordination; the Push Shot for explosive power of the arms; Standing Broad Jump for explosive power of the legs; and Dipping for strength and endurance of the arms. The reliability was found to be 0.95, with a multiple R of 0.89.

TABLE 3

Battery—Regression Coefficients and Multiple Correlation Coefficients

Test Item	I	III	IV	V	VI	VII
Squat twist	.4058	.4303				.3812
Sitting medicine ball throw		.3912				
Standing broad jump	.3361	.3176	.3942	.3466	.3169	.2960
Push shot	.3580		.3485	.4260	.3820	.3716
Potato race			.3732			
Block transfer				.2456		
Dipping				.1596	.1285	.1907
Leg raiser	.2166	.1980	.2719	.1598	.1753	
Multiple Correlation Coefficient	.9016	.9159	.8964	.8770	.9086	.8942

Summary and Conclusions

The short batteries presented in Table 3 are recommended for use in high schools. It is believed that they effectively measure a wide variance in attainment of the objectives desirable in a program of physical education. In addition, they conform to the requirements set up for a satisfactory testing medium.

1. *Reliability:* Reliabilities of individual test items are satisfactory. No battery has a reliability coefficient lower than 0.88.

2. *Simplicity and economy:* No expensive or complicated apparatus is needed. Any of the recommended batteries can be given to a class of 30 in two one-hour class periods.

3. *Interest:* Inasmuch as the various tests recommended afforded interesting competition for college subjects, it may be assumed that they will also appeal to those of high school age.

4. *Experience and development:* Exercises similar to recommended test items have been among those prescribed in individual exercise programs for physically subnormal students in corrective sections at Colorado A & M. Results have been very satisfactory.

5. *Validity:* Because of the interaction of muscle groups in movement, specificity in measurement of exclusively defined attributes can be attained

only through sacrifice of simplicity, economy and interest. It will be obvious to the critical reader that test items in the various batteries measure more than is claimed for them as a primary function.

Speed, balance, and flexibility are not mentioned as factors of primary importance in any of the test items; yet their presence or absence in the subject will affect his score. Rhythmic movement and postural symmetry are most frequently found in the individual possessing an adequate musculature and good neuro-muscular control, although their objective appraisal is both difficult and time consuming.

The general nature of the test items in the various recommended batteries detracts from their diagnostic value but increases the probability that all factors affecting physical excellence are being measured. The comparatively high coefficients of multiple correlation between the short batteries and the criterion support the contention that these are valid measures of a functionally desirable form of physical development.

6. *Norms:* Administration of the test items furnishes data for establishing norms commensurate with the environment and physical maturation of the particular group and accurately places the individual in his proper relation to those norms.

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Velocity Measurement of Fast Balls and Curve Balls

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The present study has its background in two recent investigations of batting reaction time (2, 3). In these investigations—involving starting and movement reactions in both simple and complex reaction situations—it was estimated that a batter requires for 0.21 to 0.34 seconds to react to a ball in flight.

Interpreting these times in the light of available data on the velocity of a fast ball, it would appear that a batter must obtain his information as to where a ball will be when it reaches home base far earlier than is commonly imagined. Scott (1, *p. 145–146*), for example, cites data indicating that a fast ball takes only 0.43 to 0.58 seconds to travel from the pitcher's hand to home base. If it is assumed that a fast ball is not slowed down appreciably during its flight by air resistance, it would seem that a batter must make his reaction to a ball by the time it has reached the mid-point of its flight. After the ball has passed beyond this point, there would no longer be sufficient time for a batter to complete his reaction.

To obtain further data on the demands of a batting situation, the present study was undertaken. Specifically, this study is concerned with a comparison of the velocities of fast balls and curve balls.

Method

Apparatus. A special electronic device was constructed to measure the velocity of a pitched ball. The device was designed so that the opening of a switch started a standard electric clock and a sound wave stopped the clock.

In order that the grasp and release of a ball would act as a switch, a regulation baseball was partially coated with Du Pont's conducting silver #4817, and small copper electrodes were designed for the last phalanx of the index and adjacent fingers. When a pitcher held the ball with the electrodes across the coated area of the ball, the electrical action was that of a closed switch. Release of the ball in pitching served to open the switch and trigger the timing device. By placing a speaker unit within two feet of home base, the sound waves created in catching the ball over the base was used to stop the timer.

Calibration of the electronic device showed its error to be far below that of the $\frac{1}{100}$ second electric clock used to measure the duration of ball flight.

Procedures and Subjects. Since the normal outdoor sounds of automobile traffic and other city activities interfered with proper operation of the timer, it was necessary to conduct the study in the relative quiet of a gymnasium. The regulation pitching distance of 60.5 feet was marked off on the floor. A

block of wood, 24 inches long and 6 inches wide, was nailed to the floor for a pitcher's box. A second block of wood, 17 inches across the front, served as home base.

Each subject threw 20 fast balls and 20 curve balls. Before any series of trials, a subject was allowed to warm-up in his customary manner. During any series of throws, a subject was allowed to rest for any length of time he deemed necessary.

Six members of the Indiana University pitching staff during the school year 1950–51 served as subjects.

Results

Table 1 summarizes the data on the time required for fast balls and curve balls to travel from the pitcher's hand to home base. For the individual pitchers used in this study, the mean duration of flight for a fast ball ranged from 0.47 to 0.59 seconds. These values are comparable to the values of 0.43 to 0.58 seconds cited by Scott (1; *p. 145–146*).

The mean duration of flight for curve balls ranged from 0.54 to 0.70 seconds. The difference in duration of flight between fast balls and curve balls ranged from 0.07 to 0.11 seconds.

The velocity estimates for fast balls and curve balls are presented in Table 2. To make allowances for the fact that a pitcher steps forward from the box during his delivery, the velocity calculations are based on an estimate of 56

TABLE 1

Duration of Ball Flight from Pitcher to Home Base (in sec.)

Pitcher	Fast Ball		Curve Ball	
	Mean	Range	Mean	Range
C	0.47	0.46–0.47	0.54	0.52–0.55
H	0.47	0.44–0.49	0.57	0.56–0.59
B	0.53	0.50–0.58	0.61	0.58–0.64
D	0.53	0.51–0.56	0.64	0.61–0.67
W	0.55	0.54–0.57	0.62	0.59–0.70
R	0.59	0.55–0.65	0.70	0.63–0.75

TABLE 2

Velocity of ball during pitch (ft. per sec.)*

Pitcher	Fast Ball		Curve Ball	
	Mean	Range	Mean	Range
C	119	119–122	104	102–108
H	119	114–127	98	95–100
B	106	97–112	92	88–97
D	106	100–110	88	84–92
W	102	98–104	90	80–95
R	95	86–102	80	75–89

*Calculations are based on an estimate of 56 feet as the distance ball travels in passing from pitcher's hand to home base.

feet as the distance a ball travels in passing from a pitcher's hand to home base. These velocity estimates also assume that a ball is not slowed down appreciably during its flight by air resistance.

For the individual pitchers co-operating in this study, the mean velocity of a fast ball ranged from 95–119 feet per second. The mean velocity for a curve ball ranged from 80–104 feet per second.

On the basis of results reported in this study, it would seem that the demands of a batting situation are more exacting than commonly imagined. If, for example, it is assumed that batters against the pitchers used in this study have batting reaction-times within the limits of 0.21 to 0.34 seconds as reported in recent studies (2, 3), it becomes evident that a batter cannot wait until the last few feet of ball flight to make his reaction. For the slowest pitcher in this study, a fast ball can be no closer than 20 to 32 feet of home base if the batter is to have time to make his reaction. A curve ball can be no closer than 17 to 27 feet of home base.

For the fastest pitcher in this study, a fast ball can be no closer than 25 to 40 feet of home base. A curve ball can be no closer than 22 to 35 feet of home base.

Summary

The velocity of fast balls and curve balls was estimated for six members of the Indiana University pitching staff. It was found that the velocity of a fast ball ranged from 95–119 feet per second. The velocity of a curve ball ranged from 80–104 feet per second. Some implications relative to the demands placed upon a batter were noted.

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Swimming as an Etiologic Factor in the Incidence of Certain Otorhinologic Conditions in College Men

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IT IS A matter of historical record that swimming has been a favorite sport for man since the dawn of human existence. Evidence of the interest and participation in aquatic activity are prominent in the chronicles of the ancient civilizations of Egypt, Western Asia, Greece, and Rome.

Swimming and water sports have continued to increase in popularity throughout the world in general and the United States in particular. With the development of facilities in schools and colleges during the past decades, aquatics have been accorded a position of ascending importance in the modern physical education curriculum.

However, the accelerated growth of aquatic activity has been somewhat impeded by coincident reports attesting to the causative role swimming plays in the production of certain ear, nose, and throat infections. That the genesis of these pathologies is brought about by the physical, chemical, thermal, or bacteriologic characteristics of the water is a premise basic to the postulation of causal relationship. The medical literature reveals a significant number of reports alluding to the otorhinologic sequelae of participation in aquatic sports. On these other hand, many swimming coaches and enthusiasts have argued that these pathologic aftermaths of swimming and diving have been rather exaggerated and that the causal relationship may be more apparent than real.

Review of the Literature

Reference to the cause-effect association existing between swimming and infection of the upper respiratory tract appeared as early as 1886 when Holm (28) warned of the pathologic dangers attending ocean bathing, particularly for children. Shortly after the turn of the century medical papers by Chiba (5), Cobb (6), Schmidt (47), and Wilkinson (60) pointed to swimming and diving as a contributory factor in the production of ear and sinus infection. During this era several public health reports alluded to the pathogenic possibilities of the bacterial content of swimming pool water (22, 31, 41). The influence of cold water on the homothermal nature of the human organism was an area of consideration explored by a few early writers (34, 35, 39) and probably served as a basis for later investigation of this aspect of aquatic activity.

During the third and fourth decades of the century, Fenton (11, 12, 13, 14, 15) reported a number of cases of otitis, sinusitis, and rhinitis which appar-

ently developed as a direct result of swimming and diving. This writer placed emphasis on the washing of the swimmer's own nasopharyngeal germs into the unprotected tissue of the sinuses and eustachian tubes by the ingress of bathing water (14).

Paralleling Fenton's work was the series of classic papers by Taylor (50, 51, 52, 53, 54, 55) stressing man's innate anatomic and physiologic inadequacy for aquatic activity. Taylor tended to minimize the significance of water contamination and regarded the chilling effects of bathing water on the body as a major factor in the etiology of otorhinologic conditions. This concept, highlighting the lowering of resistance to infection as a result of body chilling, was strongly reiterated in his later reports (50, 54, 55). Behrens (2) also regarded chilling as a pre-eminent consideration in sinusitis following swimming.

The theory of self-infection, as an outcome of the physical effects of water invasion of the nasopharyngeal zone, has been supported by Finck (16), Stark (49), Maxwell (36), Mezz (38), Neilsen (40), and the American Medical Association's Committee on the Otorhinologic Hygiene of Swimming (43). Other medical reports suggested the eustachian passages and the sinuses as areas of infection following water invasion during swimming regardless of the bacterial characteristics of the water (24, 27, 37, 46, 56, 59).

Hasty (25) and Derrick (8) have made reference to the possibility of the spread of pathogenic organisms from swimmer to swimmer in crowded pools despite the use of bactericidal agents. Reinking (42), El-Hakeem (9), and Fabricant (10) have recognized the pathogenic potentialities of the microorganisms of the waters of Mexico, Egypt, and Florida respectively.

Van Gilse (58) and Fowler and Osmun (19) have attributed new bone growth in the external auditory canal to the effects of repeated exposure to cold water. The latter investigation also produced some evidence indicating that cold water in the external meatus results in exostosis in the middle ear.

The papers of Brown (3), Roberts (45), Behrens (2), Skillern (48), and Bucy and Haverfield (4) all suggest the role of swimming in the development of complications in acute and chronic sinusitis. However, Maxwell (36), Lederer (33), and Heatley (26) tend toward the opposite view and point to other factors in the genesis of brain and skull involvement following sinusitis.

The comprehensive report by Mezz (38) recently shed more objective light on a number of considerations germane to the over-all problem. From his investigation Mezz concluded that (a) swimming and diving are significant factors in the production of otorhinologic pathologies, (b) man is not capable of preventing the invasion of water into the endonasal area, (c) the human body is not adequately protected against the vitiating effects of cold water, and (d) combined mouth and nose exhalation does not keep water out of the deeper portions of the nasal turbinates. More recently, Gallagher (20) has reiterated the general remarks of Mezz with particular consideration for swimming pools.

Analysis of the medical reports cited above affords the following rather broad generalizations:

1. Man is not well adapted, anatomically or physiologically, to aquatic activity.

2. Swimming and diving appear to be contributory factors in the etiology of otorhinologic diseases.
3. During swimming and diving activities pathogenic organisms, normally present in the nasopharyngeal tract, may be washed up into the lesser protected tissue of the sinuses and eustachian tubes.
4. The physical and chemical bacteria-inhibiting mechanisms of the nasopharyngeal mucosa may be impaired by the invading action of fresh or salt water.
5. The chilling effects of bathing water tend to minimize the motility and phagocytic function of the leucocytes.
6. The transfer of micro-organisms from swimmer to swimmer is regarded as a relatively minor factor in the production of most upper respiratory infections.
7. The symptomatology and course of otorhinologic sequelae of swimming do not differ significantly from similar conditions of a different etiology.

These summarizing statements would seem to lead to the easy assumption that aquatic activity is definitely contraindicated for both children and adults. However, it must be sharply pointed out that none of these observations, with respect to the causal role of swimming in the etiology of these infections, were the result of experimental research conducted under controlled conditions with large numbers of subjects. In the main, these medical reports dealt with case descriptions and the retracing of the patient's activities prior to the incidence of infection.

Within the field of physical education there is almost a complete absence of scientific inquiry relevant to this significant issue. Humphrey and Ferinden (29), in their recent report of an experimental study of the effect of swimming on the incidence and duration of upper respiratory infections, concluded that "there is no basis for the belief that swimming activity during the winter months results in an increase in frequency and severity of cold infections but that, on the contrary, resistance to colds can be developed through participation in aquatics." However, the use of study-hall teachers and physical educators for the diagnoses, and the acceptance of the number of days pupils were absent from school as a valid determinant of severity, serve to attenuate the conclusions of the investigation.

The lack of unanimity among medical observers, with respect to the precise determination of a dominant etiologic factor in the development of otorhinologic conditions after swimming, combined with the rather remarkable conclusions of Humphrey and Ferinden (29) indicated forcefully the need for further study in this particular area.

Therefore, with the indecisive medical opinions, the conflicting evidence of certain researchers, and the general paucity of studies on the hygienic implications of various facets of the college environment (32) as motivating factors, it was decided to conduct an experimental investigation of the problem at hand.

The Problem

It is the purpose of this study to determine the influence of participation in swimming and water sports on the development of infections of the ear, nose, throat, and sinuses.

Method and Procedures

The general method of this investigation involved a cross-sectional experimental pattern in which an attempt was made to control all factors which might significantly affect the subjects and to introduce an adequately specific variable (i.e., swimming).

The subjects for the study were randomly selected and included 194 male college students ranging in age from 17 to 29 years. Each subject completed a medical history form including all data relating to the pre-existence of chronic otorhinologic conditions, presence of tonsils and adenoids, extent of smoking, precise conditions of housing, immunizations received, and other pertinent health information. Any subject whose health history suggested a predisposition to the common cold or other infections of the upper respiratory tract was eliminated from the experiment as were those persons with chronic ear, nose, throat, or sinus conditions.

Thus, the 194 subjects represented a reasonably homogeneous group with respect to age, sex, health status, housing situation, and general daily regimen.

Of the total number of subjects, 109 were included in Group I, the Swim Group, and 85 were in Group II, the Non-Swim Group. All subjects followed the same general routine of student life except for the men in Group I, the Swim Group, who were exposed to the single variable—swimming. The subjects of Group I were all enrolled in college swimming classes and participated in aquatics twice a week. Each swimming period lasted for one hour. Subjects in Group II did not participate in scheduled swimming classes and were instructed not to engage in recreational aquatics for the duration of the study.

Each subject was instructed to report immediately to the university infirmary if, at any time during the experimental period, he experienced one or more of the described signs and symptoms of otorhinologic infection. These instructions, relating to the symptomatology of upper respiratory pathologies of an acute nature, were prepared in collaboration with staff physicians of the Department of Health Service. It was recognized that a close inter-relationship exists between the common cold and other acute conditions of the upper respiratory tract (1, 23).

Subjects reporting to the infirmary during the 60-day period of the investigation were examined by staff physicians who prepared a complete diagnostic report for each case. In this manner the untenable technique of lay appraisal of the existence and classification of infection was eliminated as a possible source of study invalidity.

Throughout the experimental phase, extending over the months of April and May, bacteriological analyses of the swimming pool water were conducted periodically by the Department of Civil Engineering. These analyses showed

that the pool water met recommended sanitary standards (17, 18, 30, 44, 57). Thus, the bacteriologic characteristics of the bathing water were known and controlled. Water contamination then could be eliminated as a prominent etiologic factor in those cases reported from the experimental group during this time. Although precise determinations of water temperature were not available, an approximate mean range of from 75° to 80° F. was maintained. The air temperatures over this period ranged from 70° to 95° F. These data refer only to that portion of the day during which the Swim Group subjects participated in aquatics. It was felt that the environmental characteristics of the experimental situation could be assumed to be rather typical of the setting, with respect to outdoor swimming pools, prevailing throughout most of the nation during the summer months.

Results

Following the experimental period, the accumulated diagnostic case reports were classified and tabulated according to the incidence of ear, nose, throat, and sinus conditions within each of the groups studied. These data afforded a valid basis for comparative analysis, with reference to the extent of incidence of otorhinologic pathologies, of the Swim Group and the Non-Swim Group.

The findings are illustrated in Table 1 which presents comparative data pertaining to the case incidence of otorhinologic infection for each group, the percent incidence for individual groups, the standard error of the percentages, the standard error of the difference between the two percentages, and the critical ratio as an index of significance.

TABLE 1

Comparative Incidence of Otorhinologic Conditions among Swimmers and Non-Swimmers

Group	Total Number*	Number Cases	Percent Cases	$\sigma_{\%}$	$\sigma_{D\%}$	t
Swimmers	109	9	8.3	2.6	3.11	1.90
Non-swimmers	85	2	2.4	1.7		

* The variation in N resulted from the elimination of those subjects whose health histories showed a subacute or chronic otorhinologic condition.

In interpreting the data it is apparent that the Swim Group exhibited a higher percent incidence of otorhinologic infection than did the Non-Swim Group. However, statistical analysis affords a more meaningful comparison of the groups with respect to whether or not a true, or significant, difference existed. The obtained critical ratio of 1.90 is significant at the 0.06 level of probability but does not attain the 0.05 or 0.01 levels required for rejection of the null hypothesis (7, 21). The inference then is that the observed difference in the incidence rates of the groups studied is a result of sampling error rather than any effect of the experimental factor—swimming.

Summary and Conclusions

A cross-sectional experimental investigation was conducted to determine the influence of aquatic activity in the development of certain otorhinologic pathologies. The subjects, randomly chosen from a relatively homogeneous population of male college students, followed the same general regimen except for the experimental variable of swimming and water sports activity. The Swim Group (109 subjects) participated in aquatics in an outdoor fresh water pool twice a week for a period of one hour per session. The Non-Swim Group (85 subjects) did not engage in swimming activity during the 60-day experimental stage. Subjects were instructed to report immediately to the university infirmary if they experienced any of the signs or symptoms of ear, nose, throat, or sinus infection. Individuals reporting were examined by staff physicians who prepared complete case reports with special reference to the problem under consideration. Cases of upper respiratory pathology were tabulated for each group and incidence rates were computed for the purpose of objective comparison.

On the basis of the obtained data it would seem that, for similar groups participating under comparable conditions oe environment, the following conclusions are justified and substantiated:

1. Participation in swimming and water sports does not result in a significantly increased incidence of otorhinologic infection.
2. Resistance to ear, nose, throat, or sinus infection, including acute coryza, is not markedly altered by engaging in aquatic activity.
3. From the standpoint of student health, swimming is not contraindicated for the college physical education program.
4. Research of a similar nature is indicated for other age groups, particularly with children at the elementary school level.

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Democratic Methodology in Physical Education[1]

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THE AIM OF this study was to explore and test some teaching methods in physical education that gave promise of contributing to the educational ojective of furthering democratic principles by translating democratic tenets into democratic action on the playfield and in the gymnasium.

The Problem

Mid-twentieth century finds our world at the crossroads of two opposing ideologies. It is apparent that the travelers on the communistic road intend to block and destroy the democratic highway. It is very possible that this communistic roadblock might lead to the destruction of the democratic thoroughfare unless America and the free world re-pave their road with materials so enduring that a truly *free*-way will result. The current world crisis is much more than one of technological warfare. It is an ideological battle which can be truly won only in the hearts of man. Educating youth for democracy involves more than indoctrinating them with the verbal tenets of democracy. Young people must not only understand the semantics of democracy, but they must experience it in their daily lives.

Physical education has innate advantages over many other school subjects for implementing democratic experiences. Play is a powerful motivator, and the inherent game elements of co-operation in a framework of competition provide a meaningful context for living rather than just talking democracy. But just exposing youth to athletics is insufficient to guarantee the desired democratic outcomes. The totalitarian dictators capitalized on these potentialities to implement their ideologies. How, then, can democracy utilize physical education's inherent values to further its ideology?

Procedure

In trying to answer this question, this investigation was divided into two parts. Part One explored the historical evidence that indicated that physical education had been used throughout ancient and modern times to foster ideologies, and set forth a sociological and psychological justification for democratic methodology. The tenets and elements of democracy as stated by the consensus of the President's Commission on Higher Education were presented

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comcomitantly with specific action methods for their implementation that were applicable in high school physical education classes.

Part Two described some of the outcomes of this methodology as demonstrated empirically and sociometrically in three upper division classes in girls' physical education in a large city high school during one 18-week semester. The authoritarian administration of this school gave co-operative sanction to the trial of democratic practices in these classes within rather rigid limits imposed by its autocratic policy. Inadequate play space and large classes imposed further limitations. In this setting, 141 girls participated in a program which aimed to provide meaningful situations for the practice of democratic living. These situations were created by explicit environmental manipulation devised to foster a democratic class climate. The need for and some results of this manipulation were pointed up by the findings of a planned series of sociometric tests, and empirical observation.

The following sociometric tests were given:

(1) *Acquaintance volume tests:* The purpose of these tests was to measure the increase in acquaintanceship in the classes during the term and thus partially determine the extent of interaction. On the first and last days of class each girl listed the classmates whom she knew by first and last names.

(2) *Functional choice tests:* Three times during the term, the first and last days of class and halfway through the semester, the pupils submitted a confidential list of not more than five girls whom they would prefer as squad-mates of the ensuing activity unit. The students were also permitted to designate any classmates whom they did not wish to have on their squad. The purposes of these tests were:

(a) To serve as the basis for squad assignments.
(b) To locate the chosen and rejected students.
(c) To determine changes in individual status and group cohesion.
(d) To verify empirical observation of the nature of the needs of individuals and groups for guidance aimed at the improvement of interpersonal relationships.

To supplement and assist in the interpretation of these objective data, relevant background information on each pupil was obtained from school records, counselors, and other teachers. Anecdotal records of significant behavior were kept, and conferences were held with faculty, parents, students, school nurse, school doctor, and juvenile court authorities.

Explicit effort was made to translate democratic principles into action situations so as to: increase interaction through participation; effect upward mobility; increase group cohesion; decrease the number of rejects, isolates, and near-isolates; improve physical and communicative skills; and induce pupil cognizance of the process, values, and limitations of democracy. The multifarious devices used to achieve these aims were selected in accordance with the dynamics of each class situation. No constellation of set methods can be prescribed to cope with all exigencies, but throughout the term the following procedures were used in all classes:

(1) The democratic process was discussed, and by joint teacher-pupil planning and group process techniques the classes were conducted as laboratories of democracy. By reciprocal assumption of the expert and member roles, the instructor and the pupils shared responsibilities in accordance with their maturity and abilities.

(2) To induce interaction, squads were selected anew for each activity unit on the basis of stated preferences on the functional choice tests. Student-elected officers were chosen every three weeks, and opportunities were provided to further acquaintanceship through mixers, tournaments, etc.

(3) Individual and group guidance techniques were used to foster upward mobility and increase group cohesion.

(4) Opportunities were provided to encourage self-direction, responsibility for one's own actions, self- and peer-evaluation on the basis of merit only, recognition and empathy for individual differences, and competition in a framework of co-operation.

(5) Buzz sessions, sociodrama, and problem-solving devices were used.

Findings

In all three classes the average acquaintance volume per pupil almost doubled during the term. The gains for each class expressed in percentage of new acquaintances made in eighteen weeks were, 50.4, 44.81, and 40.4, respectively.

Upward mobility was experienced by 75 percent of the combined classes, downward mobility by 13 percent, and 12 percent evidenced no change in individual status as measured by the Individual Status Index.[2]

A slight but measurable gain in the "we-feeling" or group cohesiveness was evidenced in these classes by slight termwise increases in Group Cohesion Scores.[3] In one class there was a mid-semester decrease in the GCS which was later counteracted; the group's final GCS showed an over-all increase in cohesion as measured by this criterion. The other two classes demonstrated small, but steady, gains in the we-feeling throughout the term.

In the total group there was approximately a 50 per cent decrease in the number of girls rejected and a 60 per cent decrease in the total number of rejections when the start and end of the terms scores were compared. Of the original total of 8 isolated and 27 near-isolates, there remained 3 isolates and 11 near-isolates on the last day of class. These data were based on the choice and rejection patterns evidenced by the sociometric tests.

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[2] Individual Status Index $= \frac{\text{Total Choices minus Total Rejections}}{\text{Number in group minus one}}$ or ISI $= \frac{TC - TR}{N - 1}$

[3] Group Cohesion Score $= \frac{\text{Total Choices in group minus Total Rejections in group}}{\text{Number in group times Number in group minus one}}$

or GCS $= \frac{TC - TR}{N(N - 1)}$

The students' own reactions to the democratic methodology they had experienced in their classes were expressed anonymously in a "Student Evaluation Questionnaire" circulated the last day of the term. The only unanimity in the replies to 44 questions was in the response to the item, "Do you feel that anyone in this class was "left out" of any activities because of her religion, race, nationality, or economic status?" All pupils indicated "No" to this inquiry. All but one girl approved of the practice of settling class problems by discussion and consensus. On the whole, the large majority enjoyed their class, favored the devices used to increase leadership, interaction and self-direction, and, in general, were enthusiastic about the manner in which their class had been conducted.

All the objective findings accurately reflected the investigator's empirical observations.

A study of historical, sociological, and psychological foundations justified democratic methodology in physical education. That these methods were practical even in an administratively authoritative framework of a large, city high school was demonstrated by their use in there girls' physical education classes during one semester. Based on the empirical and sociometric data which evidenced a termwise increase in acquaintance volume, upward mobility, and group cohesion, and a corresponding decrease in the number of rejects, isolates and near-isolates, plus the approval and satisfaction of the students themselves as shown by an unsigned questionnaire, it was concluded that the use of democratic methods in three girls' high school physical education classes resulted in socially desirable democratic outcomes.

Conclusions

The findings of this study lead to the following conclusions:

(1) Democratic methodology in physical education can be justified historically, sociologically, and psychologically in accordance with the current knowledge in these foundational fields.

(2) Some aspects of democratically desirable human relationships as evidenced in physical education classes can be measured objectively by use of sociometric techniques.

(3) When democratic methodology was employed in three high school girls' physical education classes during an 18-week term in the setting of a large, city high school with an authoritative administration:

(a) Empirically, the methods were found to be practical.

(b) The sociometric data reflect the empirical observations that the following outcomes occurred:

1. Marked interaction was evidenced by greatly increased acquaintanceship.
2. Upward mobility was experienced by the large majority of the students.
3. A decrease occurred in the numbers of the unchosen, slightly chosen, and rejected girls.
4. Group cohesion increased slightly.

5. The large majority of the pupils expressed approval and satisfaction.

(c) Therefore, since these outcomes are among those deemed socially desirable in a democracy, the methodology used in these classes appeared to have contributed to the furtherance of the democratic ideal among its members.

(4) If, then, the democratic potentialities inherent in the sport context were implemented in each school physical education class by democratic methods, and, if the outcomes of improved human relationships reflected those which occurred in this 18-week study, American youth should find the kindergarten through junior college physical education requirement a long-term, effective, enjoyable, and meaningful experience in democratic living.

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A Scoring Table for Two-Minute Sit-Ups

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The problem attacked is the construction of an achievement scale in the performance of two-minute sit-ups.

Need for the Study

Throughout the physical education literature, there have been many references to the use of sit-ups as a testing device. In many instances, the standards for performing sit-ups have come from one of the branches of the armed forces. For example, Clarke (2) includes the "T-Scores for Navy Standard Physical Fitness Test," which includes scores for unlimited sit-ups. Havlicek (4) suggests that "three-minute sit-ups be given in place of continuous sit-up performance because of its more accurate measurement of abdominal strength and the shorter time required for its completion." Included in his article are T-scores for sit-ups for periods of two minutes, three minutes, and five minutes, based apparently on performance of AAF meteorological personnel.

In the process of administering a physical fitness test using unlimited time sit-ups, the department of Required Physical Education at the University of Florida became quite concerned with the time consumed in administering the test, as well as the objectivity. It was decided to try speed sit-ups.

A conclusion was reached to use two-minute sit-ups, based mainly on empirical judgment using the criteria of administrability, particularly time. In a perusal of the literature, standard scores for two-minute sit-ups based on college population could not be found and it was therefore necessary to establish T-scores in order to combine the sit-up scores with other items in the test.

Collecting the Data

The 1,312 men used in the construction of this T-scale were students at the University of Florida who were enrolled in the Required Physical Education classes. All of these students had completed at least one semester of physical education, while many of them had completed two, three, four, five, six, seven, and eight semesters of physical education.

The exercise position used is described as follows. One student would lie on a mat in a supine position so that his feet were toward the edge of a wrestling mat, permitting his partner to kneel on the edge of the mat holding the heels to the mat by holding the ankles with sufficient pressure to have the performer keep his knees as straight as possible. The performer would interlace his fingers behind his neck. In doing the sit-ups, he would raise the trunk, turning slightly so as to enable the right elbow to touch the left knee, and then return to a supine position, with head or hands touching the mat, and then raise the

trunk, turning slightly, touching left elbow to right knee. As the student completed each sit-up, his partner (partner holding feet) would count audibly so that the performer would know at all times the number of sit-ups completed. A faculty member supervised each five pairs of students.[1] The entire group was timed by an instructor who started and stopped them. The starter also informed them when 30, 60, and 90 seconds had elapsed.

A T-scale table was constructed following Scott and French (6). The results are presented in Table 1.

TABLE 1
T-Scores for Sit-Ups, Two Minutes

Raw Scores	T-Scores	Raw Scores	T-scores
86	82		
85	79	55	49
84	77	54	48
83	76	53	47
82	75	52	46
81	74	51	46
80	73	50	44
79	71	49	43
78	70	48	42
77	70	47	41
76	69	46	41
75	68	45	40
74	67	44	39
73	66	43	38
72	66	42	37
71	65	41	36
70	64	40	35
69	62	39	33
68	61	38	32
67	61	37	32
66	60	36	31
65	59	35	30
64	58	34	29
63	57	33	28
62	56	32	28
61	55	31	27
60	54	30	26
59	53	29	25
58	52	28	23
57	51	27	21
56	50	26	20
		25	20
		24	16

[1] The writer is indebted to the faculty members of the Required Physical Education Department who administered the test.

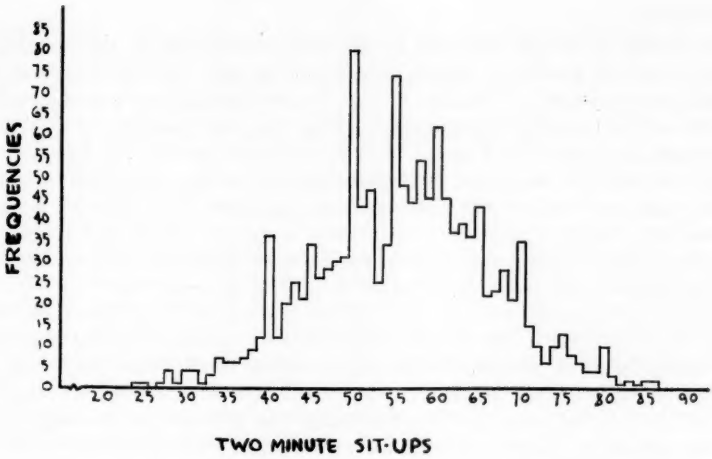

Fig. I. Number of Sit-ups in Two Minutes; Size of Interval, One

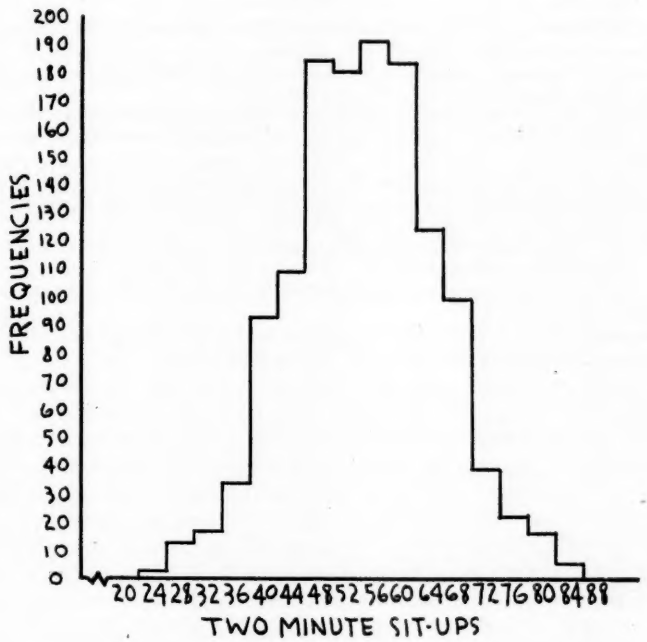

Fig. II. Number of Sit-ups in Two Minutes; Size of Interval, Four

Discussion

In constructing the scale, the writer became interested in the assumption that is held to justify the use of the T-score method. McCloy (5) states the assumption this way: "The use of the T-score presupposes a normal distribution of the variable being scored." Was the data collected in this study adequate to construct a T-scale? In order to think through this question, the data was placed in an outline histogram, Figure I, using a step interval of one. It is quite obvious that the raw scores in multiples of five present a modal peakedness which would tend to indicate a psychological or physiological influence to reach these multiples. From this observation of the data, what are the implications for the administration and use of the sit-up test?

Going one step further, the statistician tabulates his data into class intervals. Walker (7) says, "In general, the form of distribution appears to greatest advantage when the number of intervals is not less than 10 nor more than 20."

Figure II presents a histogram of the same data in 16 class intervals, with size of the interval being four. In comparing these histograms, one might jump to the subjective opinion that the data in Figure II follow the normal curve, but one might hesitate to state that the data in Figure I follow the normal curve.

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The Sit and Reach—A Test of Back and Leg Flexibility

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IN A BATTERY of tests used to assess the physical fitness of freshman and sophomore women at Wellesley College, one of the tests used was the "Standing, Bobbing" test (1, *p. 181*) described by Scott and French. In this test the subject stands on a gymnasium bench, letting the arms and trunk relax forward with the hands in front of a vertical scale which is attached to the front edge of the bench. In this position the subject bobs downward four times, keeping the knees straight, and on the fourth reach holds still in the position of maximum forward-downward flexibility.

The Problem

For many students, the feeling of insecurity and apprehension involved in the "Standing, Bobbing" test was sufficient to prevent them from making a maximal effort. Because of their dissatisfaction with this test, the authors were interested in finding one which contained no element of fear.

The "Sitting, Bobbing" test (1, *p. 183*) was considered, but was rejected because it did not provide for accurate measurement and because there seemed to be no way to prevent sliding on the floor when a maximum forward reach was attempted. Bracing the feet against the wall automatically limited the reach to the level of the feet. In an attempt to combine the good features of both tests and to eliminate the undesirable features, the authors devised a horizontal scale which was elevated from the floor a sufficient distance to clear the feet of a subject sitting with legs extended and feet at right angles to the floor.

The Test

EQUIPMENT

The equipment for this test consists of a platform scale, two gymnasium benches, and a piece of rubber matting about four feet square. The platform scale consists of a scale similar to that used by Scott and French for the "Standing, Bobbing" test. On firm cardboard, or better yet plywood, approximately 24 x 8 inches, lines are drawn horizontally at half-inch intervals. The center line is marked 0, the inch lines on one side are marked 1, 2, 3, etc., and those on the other side, −1, −2, −3, etc. The support for the scale is in the form of an elongated plus sign made of 11-inch boards resting on their edges (Fig. I).

For convenience, these may be referred to as the cross board and the stem board (actually two boards placed in line with each other on opposite sides of the cross board). Footprints are outlined on one surface of the cross board, one on either side of the stem board. The scale is attached to the upper

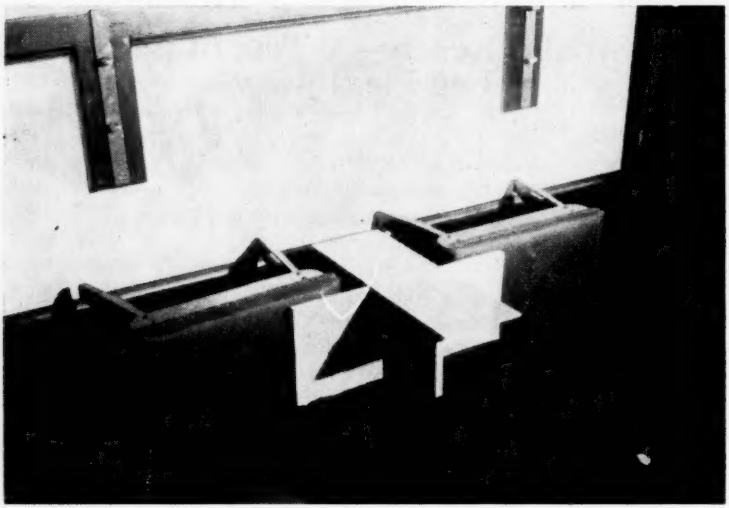

Fig. I. Horizontal Scale for Sit and Reach Test

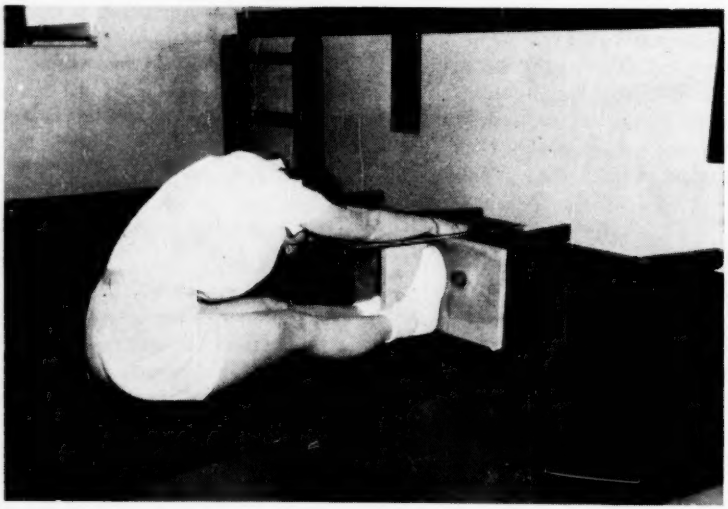

Fig. II. The Sit and Reach Test

edges of the support in such a way that when the subject is seated on the floor with the feet against the footprints, the zero line coincides with the near surface of the cross board and the minus values are toward the subject.

The equipment is placed near a wall. The two benches are placed side by side on their sides about 12 inches apart, with their legs against the wall. The platform scale is placed between the benches with the cross board braced against the benches and with the plus numbers toward the wall. The rubber matting is spread on the floor in front of and partially under the scale (Fig. I).

DESCRIPTION

The subject sits on the rubber matting with knees straight, legs separated just enough to straddle the stem board of the scale platform, with the feet placed in the footprints on the cross board and pressed firmly against the board. The arms are extended forward with the hands placed palms down on the upper surface of the scale. In this position the subject bobs forward four times and holds the position of maximum reach on the fourth count (Fig. II).

The score is the most distant point reached and held on the fourth movement. The test administrator stands close beside the scale and notes the most distant line touched by the finger tips of both hands. If the hands reach unevenly, the hand reaching the shorter distance determines the score. The score is taken to the nearest half inch. If the reach appears to be exactly half-way between two lines the score is based on the last line actually touched.

Procedure

One hundred students who were enrolled in required physical education courses at Wellesley College served as subjects for this study. All tests were administered by the same person and in the same manner.

Before being tested each student did warm-up exercises for approximately three minutes, then performed tests of back and leg flexibility eight times. Fifty per cent of the group did two Sit and Reach tests, two Standing Bobbing tests, two Sit and Reach tests and two Standing Bobbing tests, in that order. The other fifty per cent of the students did two Standing Bobbing tests, two Sit and Reach tests, two Standing Bobbing tests and two Sit and Reach tests.

Statistical Treatment of Data and Results

The data available were four scores for the Sit and Reach and four scores for the Standing Bobbing tests for each of the one hundred students. Means and standard deviations for each test were determined. These were based on the four scores for each of the 100 subjects.

The reliability of each test was determined by the odd-even method. The sum of the first and third trials was correlated with the sum of the second and fourth trials. The Pearson Product Moment method was used. The validity of the Sit and Reach test was determined by correlating the sum of four trials for the Sit and Reach test with the sum of four trials for the Standing Bobbing test.

The mean and standard deviation for the Standing Bobbing test were 3.36 and 2.11 respectively. The mean and standard deviation for the Sit and Reach test were 4.40 and 2.06 respectively. The reliability of the Standing Bobbing test was 0.96 and the reliability of the Sit and Reach test was 0.98. The validity coefficient obtained for the Sit and Reach test was 0.90.

Conclusions

The following conclusions appear justified:

1. The Sit and Reach test is a valid test of back and leg flexibility, insofar as its validity is measured by the Standing Bobbing test. This is indicated by the validity coefficient of 0.90.
2. The Sit and Reach test is a highly reliable test, as is indicated by the coefficient of correlation of 0.98.
3. Scores for the Sit and Reach test tend to be consistently higher than scores for the Standing Bobbing test.

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RESEARCH ABSTRACTS

Prepared by the Research Abstracts Committee of the National Council of the Research Section, Carolyn W. Bookwalter, Chairman

Anatomy, Anthropology, and Physiology

1. ANDERSON, T. P., K. G. WAKIM, J. F. HERRICK, W. A. BENNETT AND F. H. KRUSEN. An experimental study of the effects of ultrasonic energy on the lower part of the spinal cord and peripheral nerves. *Arch. Physic. Med.*, **32**(2): 71–83 (1951).

Ultrasonic waves in maximal doses applied to the lower part of the spine of dogs and rats caused paralysis of the hind legs and tail. This effect was not caused by heat, because marked destruction of the cord was observed when temperature remained 42°–43°C.—*Peter V. Karpovich.*

2. HELLEBRANDT, F. A., S. J. HOUTZ, R. N. EUBANK. Measurement of whirlpool temperature, pressure, and turbulence. *Arch. Physic. Med.*, **32**(1): 17–26 (1951).

Investigators described methods for measuring whirlpool temperature, pressure, and turbulence. The exploratory tests indicate that there is a great deal of variation in these three characteristics of whirlpool bath, depending on its construction.—*Peter V. Karpovich.*

3. SUMMERR, T. B. AND H. M. HINES. Effect of immobilization in various positions upon the weight and strength of skeletal muscle. *Arch. Physic. Med.*, **32**(3): 142–145 (1951).

Gastrocnemius and soleus muscles in 59 cats were used. The muscles were immobilized in neutral, shortened and extended positions for 14 to 42 days. The greatest atrophy was obtained in shortened position. In extended position, after 14 days a *hypertrophy* developed, and atrophy occurred only after 28 days. Immobilization in neutral position proved to be least deleterious. —*Peter V. Karpovich.*

4. SWEENEY, F. X. AND E. K. STONER. Hot packing. *Arch. Physic. Med.*, **32**(4): 206–210 (1951).

Hot packing of one thigh causes reflex peripheral vasodilation in the fingers and toes of both hands and both feet. The original t° of packs was 65°C. The skin t° rose rapidly over 40°C. but in a few minutes was about 36°C. The t° of deep muscle was very little affected. The highest tolerable to skin t° is between 45° and 50°C.—*Peter V. Karpovich.*

Education

5. COLADARCI, ARTHUR P. Preprofessional experiences in educational psychology: a review of opinion and a critical note. *Bulletin of the School of Education, Indiana University*, **27:** 5 (Sept. 1951).

A review of the literature, relative to expressions of a need for improvement, relation between knowledge of content and success in teaching situations, opinions of teachers and teacher educators with respect to the relative values of content areas, and opinions of educational psychologists with respect to the relative values of content areas, is given. It is clear that "success" in the teaching situation is not a function of the more or less singular value of factual knowledge within common content areas in educational psychology or of content *per se* at all. Nor is it apparent that a relative validity can be established by eliciting the opinions of those who presumably are most competent to make such a judgment—"successful" teachers.

The amount of space devoted to the several content areas by textbook writers seems not to be an indication of the opinions of educational psychologists in general.—*Carolyn Bookwalter.*

6. MUELLER, FRANCIS J. Trends in student ratings of faculty. *Bulletin of the American Association of University Professors*, **37:** 2 (Summer 1951).

Reports from 804 colleges and universities were included in the survey. This number constituted 80.7% of all colleges of the United States listed in the *Education Directory*. Of the reporting institutions, 26% were uninterested in student ratings, 35% were interested short of trial, and 39% were experienced with such ratings.

Publicly controlled colleges and universities (exclusive of teachers colleges) showed the greatest interest, while comparable independent and Protestant institutions lagged appreciably. Catholic colleges and universities and teachers colleges proved to be the least interested. The apparent apathy of teachers colleges toward student ratings came as somewhat of a surprise, particularly since some writers have strongly urged that prospective teachers develop a consciously critical attitude toward good and poor teaching. It was found that coeducational institutions manifested, by far, a greater interest in student ratings of faculty than all-male and all-female colleges. These latter, on the other hand, scarcely differed in their respective levels of interest. Colleges and universities which held regional and/or Association of American Universities accreditation exhibited the greatest degree of interest in the ratings. Next came those institutions which held "other" (largely professional) forms of accreditation, while by all odds the least interested were those institutions which could claim no accreditation. In general, the over-all interest in faculty ratings by students increased with enrollment and appeared to be greatest in the central and western portions of the United States.—*Jackson M. Anderson.*

7. RESEARCH DIVISION, NEA, Legal status of the school superintendent. *Research Bulletin*, **29:** 3 (Oct. 1951).

State codes and compilations of laws were searched for legislative enactments regarding city and county superintendents. The city superintendency has developed without much legislative direction, though the city boards of education select the officers. The county superintendency has traditionally been held by political officers but the trend is to appointment by the county board. City superintendents are employees of the city board of education while county superintendents are considered county officers in many states and are constitutional officers in 13 states.

Certification standards and tenure standards for both types of officers are given. Also listed are the statutory provisions for county superintendents' salaries.—*Carolyn W. Bookwalter.*

Nutrition

8. LEVERTON, RUTH MANDEVILLE, MARY ROSE GRAM, AND MARILYN CHALOUPKA. Effect of the time factor and calorie level on nitrogen utilization of young women. *J. Nutrition*, **44:** 4 (Aug. 1951).

Sixteen young women served as subjects for this 54-day study. One group of 8 subjects had a daily protein intake of 43 gm. and the other group of 8 had 63 gm., otherwise the dietary control was identical for the two groups. There were three consecutive 18-day periods with calorie intakes of 1,800, 2,400, and 1,800 respectively. The last nine days of each period comprised a metabolism period. In the first and second periods there was no animal protein in the noon meal, but in the third period the total intake was redistributed so that the animal protein was present in the noon meal as well as in the morning and evening meals. For both groups, increasing the caloric intake from 1,800 to 2,400 had a definite sparing action on nitrogen. The group on the lower protein intake had a significantly lower ordinary excretion in the third period, when there was animal protein in every meal, than in the first period, when it was absent in the noon meal. The other group showed no difference in urinary excretion between the first and third periods. It appears that the lower the intake of protein and calories, the greater the need for including high quality protein in each meal if nitrogen is to be well utilized.—*The Wistar Institute.*

9. McMillan, Thelma and Frances Ann Johnston. The absorption of iron from spinach by six young women, and the effect of beef upon the absorption. *J. Nutrition*, **44:** 3 (July 1951).

The objectives of the study were to determine the degree to which young women can absorb iron from spinach and whether the presence of beef in the diet mixture might increase the absorption from spinach. The amount of iron absorbed by 6 women was determined for three periods of 4 weeks each on: (1) a basal diet containing 6.44 mg. iron per day and including 110 gm. beef for dinner; (2) the basal diet plus, at dinner with the beef, 120 gm. cooked spinach containing 5.04 mg. iron; (3) the basal diet plus the serving of spinach for breakfast. No other animal protein was served for breakfast or dinner. The calculations were based on data obtained from 4 subjects. The mean absorption of iron from the spinach for 8 weeks was 13%. The mean daily differences between the total amounts of iron in the diets and those in the feces were, for the first period, 0.76 ± 0.101, for the second 1.20 ± 0.220 and for the third 1.63 ± 0.147 mg. The difference between the periods when spinach was fed for breakfast and for dinner was not significant; the difference between the basal period and the mean of the periods with spinach was highly significant. The absorption of iron from spinach compared favorably with that from a mixed diet; the presence of beef did not significantly influence the amount of iron absorbed from spinach.—*The Wistar Institute.*

10. Nasset, Edmund Sigurd and Robert Henry Tully. Urinary excretion of essential amino acids by human subjects fed diets containing proteins of different biological values. *J. Nutrition*, **44:** 3 (July 1951)

The urinary excretion of "free" essential amino acids (microbiologically available before hydrolysis) was determined in human subjects of both sexes. Six dietary periods included two in which the diet was protein-free and one each in which 30 to 35 gm. of gluten, casein, beef, or whole egg protein was added. No sex differences were detected in the excretion of "free" essential amino acids. Histidine accounted for approximately half of the total excretion. The addition of the test proteins to the protein-free diet resulted in a slight but insignificant rise in the excretion of the "free" essential amino acids.—*The Wistar Institute.*

11. Werta, Anne Williams, Priscilla Shaw Van Horn, and Lois Elizabeth Lloyd. The effect of the ingestion of alcohol on the storage and excretion of thiamine. *J. Nutrition*, **43:** 1 (Jan. 1951).

The tissue storage of thiamine and the urinary excretions of thiamine and pyruvic acid were studied in two series of experimental rats fed thiamine-low rations with and without alcohol. In series 1, two groups of 12 "paired" rats were fed isocaloric rations. In group 1, fed alcohol, mean values of 2.73, 0.42, 0.22, and 0.05 μg. of thiamine per gram of fresh tissue were obtained for the liver, heart, kidney and gastrocnemius muscle, respectively. The mean thiamine and pyruvic acid excretions were 0.54 μg. and 2.85 mg. per 24 hours, respectively. In group 2, without alcohol, mean values of 2.19, 0.43, 0.17 and 0.03 μg. per gram of fresh tissue were obtained for the liver, heart, kidney, and gastrocnemius muscle, respectively. Thiamine excretion was 0.63 μg. per 24 hours and pyruvic acid 3.79 mg. per 24 hours.

In series 2, three groups of 12 "paired" rats were studied; group 1 fed the basal ration only, group 2 fed an alcohol supplement, and group 3 fed an isocaloric dextrose supplement. Mean values for thiamine in the livers of groups 1, 2, and 3 were 2.09, 2.07, and 1.71 μg. per gram, respectively. Mean thiamine excretions for groups 1, 2, and 3 were 0.90, 0.91, and 0.75 μg. per 24 hours. Mean pyruvic acid excretions were 1.52, 1.98, and 2.07 mg. per 24 hours for groups 1, 2, and 3 respectively.—*The Wistar Institute.*

12. Westerman, Beulah Dorothea and Miriam Collyer Stone. Improving the nutritive value of flour: the significance of the use of enriched flour in the diet. *J. Nutrition*, **44:** 2 (June 1951).

A combination of natural foods similar to those consumed by human beings has been fed to albino rats. Measurements of growth through two generations and the reproduction and lactation performance were studied. When 47% of the total calories in the diets were obtained from enriched or non-enriched flour, the first generation growth test showed that the average

total gain of the animals with enriched flour in the diet was 15 gm. more than that of those fed non-enriched flour. In the second generation, those fed enriched flour gained 61 gm. more on the average than those receiving non-enriched flour. The reproduction and lactation performance was better among the rats receiving enriched flour, since a greater number of young were born and a greater number weaned by the females receiving this diet. The second experiment was based upon diets eaten by some school children in Kansas, and 48% of the total calories were obtained from cereals. In the growth test the animals receiving enriched flour in the diet gained on the average 11 gm. more in the first generation and 30 gm. more in the second generation than those receiving non-enriched flour. More young were produced and more of the young were weaned by the females with the enriched flour in the diet than by those receiving non-enriched flour. These experiments have given further evidence of the beneficial effects of enriching the flour in high cereal diets.—*The Wistar Institute.*

Recreation

13. ABELL, KENNETH W. Report on state recreation service survey for the American Recreation Society. *Quarterly Bulletin of the American Recreation Society*, **3:** 4 (Aug. 1951).

Questionnaires were sent to 25 states having active professional recreation organizations on the state level. The questionnaire called for pertinent information on 32 different items classified under the following four headings: state recreation service organizations; recreation areas and facilities; state recreation services; and county and community recreation services. Returns were received from 15 states.

The types of state recreation service organizations and the number of states reporting each service were as follows: independent state recreation commissions or boards, 3; recreation sections, divisions, or councils under various state departments, 10; state recreation study committees, 2; one or more full-time professional staff members and definite annual budgets, 11; advisory councils assisting their state recreation agencies, 8; some type of inter-agency committee assisting in the coordination of their state recreation service, 8. Types of recreation areas and facilities and the number of states reporting each type were as follows: federal recreation areas, 11; state-supported parks, roadside rests, and swimming and camping places, 15. State recreation services were reported as follows: publications, 15; survey services, 10; leadership training program, 14; program appraisal service, 11; film and book loan service, 7; consultant service to industry and private agencies, 10; financial state aid, 3. The following county and community recreation services were reported by all states: full-time community recreation service; full-time and part-time community programs; full-time and part-time recreation leaders.—*Jackson M. Anderson.*

14. FITZGERALD, GERALD B., AND LUCILLE BOROWICK. College recreation graduates. *Quarterly Bulletin of the American Recreation Society*, **3:** 3 (May, 1951).

The study included reports from 40 colleges and universities. These institutions represented over 83% of those offering recreation training in 1949–50. Sixteen (40%) of the reporting institutions offered graduate study in recreation, enrolling a total of 210 graduate students in this field. The total enrollment of undergraduate and graduate recreation majors was 1,544. Undergraduate degrees were awarded to 357 persons and 108 graduate degrees were granted during the year. Approximately 40% of these degrees were earned by women.

Data were submitted on job placement for 323 (70%) of the 465 graduates. Of the 323, 74% were placed in full-time recreation positions, 7% took part-time recreation positions, and 19% took jobs outside the field of recreation. The types of positions and percentage of graduates placed in each were as follows: public community recreation, 45.7%; private community recreation, 29%; institutional recreation, 6.2%; industrial recreation, 4.4%; hospital recreation, 4%; college teaching, 4%; army recreation, 3%; church recreation, 2.5%; school camping, 0.6%; and commercial recreation, 0.6%.

After comparing the findings with those of two earlier studies, the following trends were pointed out: the number of students majoring in recreation in our colleges and universities is increasing; although each year more institutions are offering major training in recreation, the number of institutions offering graduate work in this field is not materially increasing.—*Jackson M. Anderson.*

Guide to Authors

IN LINE with the overall goal of making Association publications yield the greatest value to the individual and profession, the following is a yardstick for the preparation of research manuscripts. The information as spelled out below recognizes general techniques being employed by research publications of similar nature. Copy prepared on this basis looks forward to the establishment of a standard style for all Association research studies.

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Manuscripts should be sent to the Editor who will see that each one is read by at least three members of the Board of Associate Editors. The Editor will advise the author as to the suitability of the paper or the desirability for revision. Papers are not judged by arbitrary standards of length but on their content of new research results in the field of physical education, health education, and recreation, presented with the greatest brevity compatible with scientific accuracy and clarity.

Since three members of the Board of Associate Editors review an article it is requested that three copies of the manuscript (the original and two clear carbons) be submitted in order to facilitate reviewing. One copy of the article should be retained by the author for checking against galley proofs. However, only one copy of any charts, photographs, drawings, graphs, or similar illustrative material need be submitted. They will be sent to each reviewer in turn.

Typewritten manuscript should be double spaced on white paper of ordinary weight and standard size ($8\frac{1}{2}$ x 11 inches).

The sheets of manuscript should be kept flat and fastened with clips which can be removed easily. The pages of the typewritten copy should be numbered consecutively in the upper right hand corner.

Paragraphs should be numbered consecutively throughout the manuscript, to facilitate ease of reference in case of revisions.

Documentation

Footnotes—Footnotes should be numbered from [1] up for each article. The first footnote for each article should begin with [1], a corresponding numeral appearing in the text. Footnotes should be separated from the text by lines across the bottom of the typewritten page. Sequence of information in a footnote is:

(a) number,
(b) author's first and last name,
(c) article or chapter (if any) in quotes,
(d) name of publication underscored,
(e) city published (colon),
(f) publisher,

(g) year,
(h) exact page reference.

In the event a bibliography is used at the end of an article, use above form except in (b) where author's last name comes first enabling an alphabetical listing. *Where references are listed and cited at the conclusion of the article, do not duplicate information in footnotes.*

Citation of Literature—Citations of literature should be segregated alphabetically by author's last name at the end of each article under the caption of "References." *Do not treat them as footnotes.*

Literature citations should be numbered consecutively in the order of their appearance. Their location in the text should be indicated by full-sized figures enclosed in parentheses. For example, (1, 2, 3). Care should be exercised to segregate footnotes from literature citations.

A uniform style should be maintained in writing citations. Do not enclose titles of chapters and articles in quotation marks. Italicize [underscore] names of books and publications. (See example below.)

A uniform sequence of data should be observed. The preferred sequence is: Author's name—title of article or chapter—name of book or publication—volume number—page numbers—year date.

EXAMPLE OF FOOTNOTE

[3] H. Harrison Clarke. *The Application of Measurement to Health and Physical Education.* New York: Prentice-Hall, Inc., 1946. p. 240.

EXAMPLES OF REFERENCES APPEARING AT END OF ARTICLE

1. DEAVER, G. G. Exercise and heart disease. *Research Quarterly,* **26**:24–34 1939. (periodicals)
2. OGDEN, JEAN, AND JESS OGDEN. *Small Communities in Action.* New York, City: Harper & Brothers, 1946. (books)
3. POTTER, JOHN NICHOLAS. *Physical Fitness of Junior High School Boys.* Unpublished master's thesis, University of California, Berkeley, 1942. 39 pp.

Use of Numbers

Use figures for all definite weights, measurements, percentages, and degrees of temperature (for example: 2 kgm., 1 inch, 20.5 cc., 300°C.). Spell out all indefinite and approximate periods of time and other numerals which are used in a general sense (for example: one hundred years ago, about two-and-one-half hours, seven times). Spell out numbers through ten; Arabic figures for 11 and over.

Abbreviations

The metric system being in universal usage, standard abbreviations should be used whenever the weights and measurements are used with figures, i.e., 10 kgm., 6.25 cc., etc. The forms to be used are: cc., kgm., mgm., mm., l., and m. *Gram* should be spelled out in all cases to avoid possible confusion with

grain. All obscure and ambiguous abbreviations should be avoided. No abbreviations of English weights and measures should be used. Preserve uniformity in all abbreviations.

Tables

Each table should have a descriptive heading and should be specifically referred to in the text by number, *e.g.*, "Table 10," etc., never as "the above table" or "the following table." Number tables from 1 up for the entire manuscript, using Arabic numerals. For graphic presentations, use Roman numerals. Per cent should be two words. Use per cent sign (%) in table or when it appears in parenthesis in text.

Never single space any tabular material.

Headings

Arrange article so as to indicate relative values of heading and subheadings. Usually four gradations are sufficient (a) article title, (b) first subhead appearing in boldface aligned left on page, (c) second subhead (if necessary) appearing in small caps aligned left on page, (d) third subhead, to appear in *i*talic (underscored in manuscript), not centered, but run in at the beginning of the paragraph or section.

Illustrations

Illustrative material is of two types: pen and ink drawings, which are reproduced by the line engraving process; and photographs, wash drawings, stipple drawings, in short anything containing shading, which are reproduced by the halftone process.

Line engravings are always treated as text figures and should be so designated. All drawings should be made with India ink, preferably on white tracing paper or cloth. If co-ordinate paper is used, a blue-lined paper must be chosen, as all other colors blur on reproduction; sometimes it is desirable to ink in inch squares so that the curves can be more easily read.

Lettering should be plain and large enough to reproduce well when the drawing is reduced to the dimensions of the printed page ($4\frac{1}{8}$ x 7 inches). Most figures can be advantageously drawn for a linear reduction of one-half or one-fourth. Co-ordinate lettering should be included within the chart. Do not use gummed letters, for they are easily lost.

Care should be taken not to waste space, as this means greater reduction and a less satisfactory illustration. Often it is possible to combine several curves in one figure and thus not only save space but enable the reader to make comparisons at a glance. Legends can often be included within the chart and a considerable saving in space thus effected.

Halftones are treated as plates and should be so designated. Frequently, several halftones can be grouped to form an attractive full page plate, in which case they should be numbered consecutively, in Arabic numerals, as figures of the plate. Photographs should be in the form of clear black and white prints

on glossy paper. Care should be taken to see that they cannot be bent or folded in handling *and paper clips should not be used.* All imperfections in the original copy are reproduced.

Figures and plates should each be numbered consecutively from 1 up for the entire manuscript. Use Arabic numerals to number figures, and Roman numerals to number plates. The legends for the illustrations should be typed upon separate sheets and the sheets numbered at the end of the manuscript. Care should be taken to indicate plainly in the text the exact location of all illustrations and tables.

The Association will assume complete engraving expense.

Proofreading

Author will receive galley-proof.

Mark on proof the errors that are discrepancies in transcription from the manuscript in *red* ink. Mark any changes from copy in *black* ink. The two classes of error are handled by two different operators.

Be sure to answer all queries on the proof. Write any instructions to the printer on the proof itself. (If instructions are written on separate sheets the parcel will require first class postage; if instructions are too extensive to write on proof, embody them in a letter and send separately.) Draw ring around instructions and answers to queries to avoid possibility of mistaking them for new copy. Return proof to the Editor.